Suffering for water: infrastructure, household access and its fluid negotiations in peri-urban Tamale, Ghana

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ABSTRACT

Analysis of access to water in the global South tends to disproportionately focus on the presence of water infrastructure such as the piped network to estimate the proportion of population that have access to water. While interest in access to water has advanced considerably, less research has focused on practices, strategies and experiences of everyday water access. This study engages with this issue in two neighborhoods, Kpanvo and Katariga, in Tamale, Ghana, exploring the ways in which residents negotiate to access water services in practice. Through participant observations and in-depth interviews, the study sets out to address three specific objectives, namely to understand how households experience and describe water access; to explore the various strategies and infrastructures households mobilise to gain and maintain access to water; and to examine the factors that mediate households' water access. Water infrastructure in the study neighbourhoods includes pipes, but critically also other sources of water (dams, boreholes and wells) and storage infrastructure (underground reservoirs, poly tanks, plastic drums, metal drums, earthen ware pots, aluminium pots and jerry cans) where residents store water for use during periods of interruptions of supplies. Also given that water is not always readily available in the private homes of residents, vehicles such as tanker trucks, bicycles, motorbikes and motorised tricycles are used to haul water from various sources, making them part of water infrastructure that make water flow in and to the neighbourhoods. Similarly, humans themselves, particularly women and girls, are a part of the infrastructure that make water flow as they carry water from both improved and unimproved sources to meet households water needs. Findings from the study demonstrate that continuous access to water, even if a household is directly connected to a piped water system, is impossible due to practices of water rationing, contrary to a normative assumption of universal and reliable water service provisioning associated with networked water supply. Household access to water is constructed through multiple strategies and infrastructures, mediated as much by access to financial resources as by networks of social relationships. Affluent households are able to acquire household connections, and some, *a priori* rejected connections to the pipe network due to erratic supply, in favour of the more expensive options of installation of mechanised boreholes and buying water from tanker operators. In contrast, poor households leveraged networks of social relationships to enter into tap sharing arrangements with neighbours on agreed conditions of payment of monthly service bills or gifts of water from owners of private water sources. Building on Anand (2011) and Peloso and Morinville (2014) this thesis therefore concludes that the way in which access to water needs to be understood is not simply in terms of access to pipes – as critical as they are – but also in terms of the strategies and negotiations

that structure and are embedded in practices through which access to water is gained, maintained and potentially controlled at the household and neighbourhood level. Analysing access to water in this way makes visible the various ways that humans shape water infrastructure and water access.

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DEDICATION

This work is dedicated to my late father (Ngben Jangbujah) for his unending sacrifice, and for instilling in me the most cherished virtues of hard work and dedication to duty which have shaped and continue to shape my own reality every day.

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ACRONYMS

GWCL	-	Ghana Water Company Limited
JMP		Joint Monitoring Programme
MDGs	-	Millennium Development Goals
NDPC	-	National Development Planning Commission
NRF	-	National Research Foundation
PURC	-	Public Utility Regulatory Commission
SDGs	-	Sustainable Development Goals
UNDP	-	United Nations Development Programme
UNICEF	-	United Nations Children's Fund
WHO	-	World Health Organisation

CHAPTER 1
GENERAL INTRODUCTION

1.1 Introduction

Recent years have seen increasing calls for the production of urban theory predicated on more diverse experiences, especially those that emanate from the global South (Parnell & Oldfield, 2014, Roy, 2009, Sheppard, Leitner, & Maringanti, 2013). The study of everyday practices is advocated and gaining traction as one of the useful ways of building such empirically nuanced details of urban experiences that will serve as the building blocks of a more relevant urban theory in the global South (Alda-Vidal, Kooy & Rusca, 2018). However, a key area where this has not fully been considered is with water access in the global South. While the analysis of global political economic processes shaping capital flows through city-wide infrastructures has advanced considerably, there is limited scholarship on the everyday practices of negotiating access to drinking water (Ahlers et al, 2014). There is a need to situate how water access has been understood and the limitations of this approach to help us offer avenues to be able to develop situated context relevant works that support urban theory in global South.

Access to water has been integral to development discourse in the 21st century, giving prominence in the framing of global development agendas such as the immediate past Millennium Development Goals (MDGs) as well as the current Sustainable Development Goals (SDGs). These development agendas have had a common goal of achieving certain targets regarding access to safe water. Target 7c of the MDGs was to halve, by 2015, the proportion of people without sustainable access to safe drinking water (WHO/UNICEF, 2015) and target 6.1 of SDGs seeks to achieve universal and equitable access to safe and affordable drinking water for all by 2030. Assessment of the MDGs clearly indicates that Ghana performed tremendously in regards to access to water. Not only is Ghana among the few Sub-Saharan African countries that obtained their water access targets but that her target was obtained five years prior to the end of the agenda in 2015 (WHO/UNICEF, 2015, NDPC/UNDP, 2015).

The Ghanaian government as well as WHO and UNICEF Joint Monitoring Programme however define access to water as the proportion of population using an improved drinking water source such as piped water into dwelling or yards, public taps or standpipes, but also tube wells or boreholes, protected dug wells, protected springs and rainwater (WHO/UNICEF, 2015). Access to water is thus determined on the basis of availability of or proximity to the infrastructure that supply water. With this view, a recent Joint Monitoring Programme report

indicates that 93 percent of the urban population in Ghana have access to safe drinking water (WHO/UNICEF, 2015). Although looking at access to water in this way allow for international, national and intra-national comparative analysis it tends to generalise water access conditions particularly within cities by concealing neighbourhood level everyday lived experiences and the negotiations that configure access to water in practice. Aggregate water access statistics determined on the basis of proximity to water infrastructure conceal the complex realities of access to water for many households as well as the "quotidian practices and the microspheres of negotiation" through which urban residents access water in practice (Anand, 2011:544).

There is now a growing body of literature that emphasise the inadequacy of analysing access to water based on the mere existence of water infrastructure. Focusing primarily on the existence of or proximity to water infrastructure provides little to no sense of the reliability, affordability, quality, equitability and accessibility of water as well as a household's water collection burden; key dimensions of actual access to water (Satterthwaite, 2003; Obeng-Odoom, 2012; Smiley, 2013, 2017; Amankwa et al, 2014; Mahama et al, 2014; Nganyanyuka et al, 2014). This literature orients our attention to the importance of looking at the conditions of access to water that bears directly on daily experiences and practices of accessing water particularly at the neighbourhood level, as that scale of analysis provides concrete evidence and enhances our appreciation of the complexities of access issues and the efforts needed to address them.

Literature also shows the paucity of the networked water infrastructure in cities of the global South and the resultant complexity of the water supply landscape. Not only are the piped networks partial and fragmented, but where they exist services are deficient and epitomized by rationed supply, unreliable provision, and unequal access (Jaglin, 2014). Water services are thus delivered through diverse arrangements and complex overlapping strategies (Jaglin, 2014, Bakker, 2003). The implication of this complexity is that urban households in relatively deprived neighbourhoods often must adopt multiple strategies to access water; decisions which are negotiated and rearticulated frequently on daily basis.

This thesis draws on the aforementioned bodies of work and responds to Graham and McFarlane's (2015) call for the study of the contemporary urban life as everyday infrastructural experience, by exploring the daily strategies households in Kpanvo and Katariga neighborhoods of Tamale, Ghana employ and negotiate to access water services in practice. Through qualitative interviewing and participant observation, I specifically document how households in Kpanvo and Katariga neighbourhoods of Tamale experience and describe water

access; the various strategies and infrastructures they mobilise to gain and maintain access to water; and the factors that mediate households' access to water. Attention to specific neighbourhoods is a worthwhile endeavour given that analysis of access to water are often done by taking a generalised view of the city for the sake of simplicity, which conceals or do not necessarily provide micro-level water access realities.

In the next sections of this chapter, I provide a literature review to situate the study key theoretical work and debates, and to highlight the research questions and objectives.

1.2 Heterogeneous water service delivery systems in the global South

There is increasing recognition of much disparities regarding the conditions and successes of water service provision between the global North and South. In the North, water services are largely delivered through the network approach reinforced by the 'modern infrastructure ideal' (Graham and Marvin, 2001) or the 'integrated urban ideal' (Gandy, 2004). The modern infrastructural imagination operates on the assumption of socially and spatially ubiquitous provision of water services through universal deployment of networked infrastructure (Coutard and Rutherford, 2015; Hyman and Pieterse, 2017).

This network approach and the associated modernist assumptions of water service delivery were transferred into colonial sites (Nilsson, 2016). Though water service delivery is shaped profoundly by contexts and not a simple repetition of what happens in the North (Monstadt and Schramm, 2017), the network ideal has for a long period constituted and to a large extent remains a template, standard of reference and a goal of public action (Jaglin, 2014, 2016; Coutard and Rutherford, 2015). Planners and policy makers in Africa have fervently strived to align to this circulating ideal. As such, African cities are analysed along a continuum, where urban spaces are expected to progress from 'pre-networked' to 'networked' (Jaglin, 2016).

In recent decades however, the ideological and material rationality of the modern infrastructure ideal has been interrogated not only in the global South contexts but also the North where it originated (Coutard and Rutherford, 2015). Rather than holding on to the cultures of 'normalised and taken-for granted' imaginations, one must embrace the reality of "leaky, partial, and heterogeneous" infrastructural entities in southern cities (Graham, 2010:8). The present condition and the future of cities in the South, particularly the peri-urban localities, is not one of network rather it is one of infrastructural archipelagos (Bakker, 2003, Allen et al, 2017). Urban water services are met through complex overlapping strategies; which comprise of 'islands' of networked water supply and array of other provision mechanisms (Bakker,

2003:337). Ainuson (2010) for instance describes how some neighbourhoods in Accra, Ghana, mostly inhabited by the poor are deprived of networked water services despite their location within the frontier of the urban milieu. These localities exist almost as autonomous entities with their water access plights concealed in city-wide statistics. Similarly, Wright-Contreras, March and Schramm (2017:64) illustrate 'fragmented landscape' of water supply in Hanoi, Vietnam, and how that leads to unequal access to water in different part of the city. In addition, Hossain (2012:70) characterise the 'socio-spatial fragmentation' of access to water and the associated inequalities it creates in city of Dhaka, Bangladesh. Fragmented expansion of water networks is also noted in Jaipur, India, culminating into unequal water access (Birkenholtz, 2010).

Work from these scholars shows that, in key instances water networks do not operate evenly in the urban spaces of the South, and thus raise the possibility for 'off-networked cities' particularly in Africa (Jaglin, 2016). Urban residents living in underserved areas are thus left in a perpetual practice of infrastructural improvisation to get water to sustain their everyday urban life (McFarlane, 2010). For such urban dwellers, as Graham notes: "[water] infrastructure networks are far from being black boxes that almost miraculously and invisibly bring […] water, […] instead, they are highly politicized assemblages of artefacts and practices within which continuous efforts at agency or resistance may […] allow services to be improvised often beyond the bounds of markets and strict legality" (2010: 10).

Thus, in converse to the integrated urban ideal are the actual water service provision realities in cities of the global South. The water service needs in these cities are met through what Jaglin termed the 'actual delivery system' organised around distinct arrangements of technology, management and regulation "which despite policy announcements and reforms, and notwithstanding imported models, survive and contribute to the functioning of cities" (2014:434). In Greater Maputo, Mozambique, water services in peri-urban areas are predominantly provided by what Ahlers et al (2013) identified as small-scale independent water providers who emerged as appendage to the weak formal delivery mechanisms. As many as 800 small-scale independent water providers exist in Greater Maputo, supplying water services to as much as 35 percent of the residents (Schwartz et al, 2015). Prominently, Schwartz et al (2015) illustrate how boreholes, pumps, storage tanks, and pipes are mobilized to form a single (albeit unstandardized) water delivery network and thus creating a form of infrastructural bricolage that enabled water service delivery. In Ghana, more than two-thirds of water supply

for deprived urban neighbourhoods are met by small-scale water service providers (Ainuson, 2010).

The presence of alternative water service delivery mechanisms alongside the conventional network utilities aligns with the urbanization dynamics of southern cities (Jaglin, 2014). This occasioned the call for "relativizing the role of the network and re-conceptualizing the relationship between urban heterogeneity and socio-technical diversity" (Jaglin, 2014:435). For Jaglin, the heterogeneous delivery systems should not always be associated with poverty and restricted to poor areas "but as an integral part of the material fabric of southern cities" and thus represent their adaptation potential (Jaglin, 2014:435). Since alternative water provision approaches mostly straddle formal and informal divide, scholars have engaged with and considered in detail the efficacy of this framing (Kooy, 2014, Misra, 2014, Schwartz et al, 2015, Peloso and Morinville, 2014). These works demonstrate that (in)formality is deeply entangled and pervade water supply processes, culminating in what Schwartz et al (2015:31) described as a 'meshwork' of water service provisioning. Scholars have thus offered the notion of 'co-production' (Ahlers, 2014) or 'emergent formalisation' (Misra, 2014) which they argue captures the realities and dynamics of water provision and access in the global South without falling into dichotomous traps. However, in this thesis I prefer to focus on the concept of everyday practices to understand different arrangements, practices and experiences of accessing water.

1.3 Everyday practices and urban water access

Urban water research has advanced considerably; yet there is limited scholarship on the everyday practices of negotiating access to drinking water. The study of everyday practice takes into consideration the ordinary practices of city-making or the richness of the everyday activities of urban residents (Lawhon, Ernstson and Silver, 2014; Alda-Vidal, Kooy & Rusca, 2018) to understand and theorise urban conditions. In the case of water, everyday practices are understood as the "the multiple, repetitive actions that people engage in that enable water access to be managed and extended to those otherwise cut off from a secure supply" (Peloso and Morinville, 2014:122) which, indeed represent the "building blocks of social reality of accessing water" in the urban global South (Velzeboer, Hordijk and Schwartz, 2018:120). With its focus on dynamics, relations, and enactment (Feldman & Orlikowski, 2011:1240) the study of everyday practices helps understand the complex ways households negotiate access to water. The study of everyday practices of accessing water reveals water access inequalities created and reproduced in this process (Velzeboer, Hordijk and Schwartz, 2018).

Two main seams of urban research on water in Africa, with some focus on everyday practices, can be identified in the literature. The first primarily analyse everyday practices of formal utility providers, demonstrating how their operational decisions and interactions with the pipe network mediate water access, and create differentiated water access experiences (Boakye-Ansah et al, 2016; Alda-Vidal, Kooy & Rusca, 2018; Tiwale, Rusca and Zwarteveen, 2018). Boakye-Ansah et al (2016) for instance analyse how everyday decisions and practices of water service provision by the formal utility produce disparities in water quality in the city of Lilongwe, Malawi. Alda-Vidal, Kooy & Rusca (2018) use the everyday operation and maintenance decisions and practices of water engineers, operators and plumbers to highlight how inequalities in water quantity and continuity is produced in the centralised network of Lilongwe, aggravating water access inequalities embedded in the design and development of the city's water supply infrastructure. Also, in Lilongwe, Malawi, Tiwale, Rusca and Zwarteveen (2018) demonstrate how everyday decisions of the network operators direct and divert "extra water" to elite neighbourhoods rather than low-income communities experiencing acute water shortages. The authors challenge the prevailing policy priority that increasing water supply through the construction of large-scale water infrastructure is the only ineluctable way to tackle the inadequate and unreliable domestic water supply in urban global South, and call on scholars to accord due attention to 'network-in use' when offering explanations on how inequalities in urban water access are produced.

These works together point to the inadequacy of conceptualising access to water based primarily on the existence of water distribution networks, but to also look at how everyday operational decisions about the water systems influence water access conditions in different localities within cities. While there is no work on water in Ghana that explicitly focus on the everyday practices of utility providers – very important as it may be – focusing fundamentally on the centralised piped network and their providers, as the foregoing studies did, can obscure many water access practices and experiences of urban residents as well as the various ways urban residents negotiate access to water despite the influences from the conventional water utility providers. This is the argument that I build in this thesis.

The second strand of urban water research in Africa thus analyse everyday practices of water access from the perspective of water users, pointing to important complexities of access. Smiley (2013) for instance documents the practices of residents drawing on diverse sources of water; including the formal utility and others, to explicate water access inequalities in respect

of reliability, cost and quality being experienced in the city of Dar es salaam, Tanzania. Peloso and Morinville (2014) explore, in peri-urban Ashaiman, Accra, the everyday practices involved in procuring water for daily needs that routinely lead residents outside of the official water supply system. Zug and Graefe (2014) also analyse the everyday practices of gifts of water among neighbours in Khartoum, occasioned by insufficiently performing water networks. Other works have not been explicitly identified as the study of everyday practice of accessing water, but they demonstrate that households negotiate access to water through an array of strategies (see for example Nganyanyuka et al, 2014, Dapaah, 2014, Manu, 2015, Rugemalila, 2015).

In contrast to the limited detailed account of everyday practices of water access in African contexts, are a preponderance of detailed ethnographies of water access in South Asian cities (see for example Anand, 2011, 2012, Bjorkman, 2014, Graham, Desai and McFarlane, 2015). Works in this part of the world mostly use ethnographic approaches and focus on the quotidian practices and interactions among and between formal water utility providers, politicians, plumbers and the residents of mostly informal settlements as they respond to the difficulties of water provision and access. Graham, Desai and McFarlane (2015) explore the everyday water and sanitation practices in Mumbai informal settlements to highlight how the poor are marginalised in terms of access to these services. They document how residents are entrapped in the everyday task of waiting and carrying water, paying exorbitant prices, and are vulnerable to the predatory practices of water rackets. To access a modicum amount of water, require the "negotiation of a complex circuits of predation, corruption and patronage'' (Graham, Desai and McFarlane, 2015:115). Some inhabitants claim water services by invoking social relations with their elected patron politicians. Those unable to mobilise pressure through politicians undertake surreptitious connections to the grid, enabled by informal transactions with plumbers and water engineers. Some purchase suction pumps to boost pressure, and also collect water from off-grid sources (Anand, 2011, 2012). Bjorkman's (2014) work also demonstrates how the risk of water shortages in Mumba is managed and mitigated through continuous attention to and intimate knowledge of a complex and dynamic social and political hydraulic landscape. Together, these works illustrate how access to water requires individuals to mobilise diverse relations and practices.

This thesis builds on this rich literature to explore the practices, strategies and experiences of everyday water access, making legible the complexity of the actual lived water network and the complex navigations that configure access to water in practice. It pays attention to how

households experience and describe water access, the various strategies and infrastructures households mobilise to gain and maintain access to water; and the factors that mediate households' water access. In sum, in substantiating the complexities of access to water, the research demonstrates the ways in which the presence of or proximity to water infrastructure does not equate with access in practice.

Tamale was purposively selected as the study area because while all the other metropolitan areas in Ghana witnessed a decline in the population with access to pipe-borne water between 2000 and 2010, Tamale recorded an increment of 9 percent. Though the level of increment was low, Tamale is adjudged to have better access to water relative to access levels in other cities in Ghana (Fuseini and Kemp, 2016, The World Bank, 2015). Yet as outlined earlier, declarations regarding increased access to water can be misleading (Obeng-Odoom, 2012) and Tamale's case thus warrants careful case assessment to ascertain how water access is lived in real life. There is also relatively little research on access to water in Tamale, specifically in the city's peri-urban neighbourhoods compared to the proliferating studies on water access in the southern part of Ghana, especially in Greater Accra Metropolitan Area. Existing research has also concentrated only on analysing determinants of water quality (Boateng et al, 2013, Cheng et al, 2013) and assessment of the nature of operations of informal water supply services and their associated effects on household water access (Awepuga, 2015). This study therefore explores the everyday practices of negotiating access to water among both households with pipe connections and those without in Kpanvo and Katariga neighbourhoods of Tamale in order to understand the realities of access to water.

The plan of the thesis is as follows: chapter one has introduced the research by providing the background of the study and positioning it within the relevant literature. Chapter two discusses the study's methodology and methods. Chapters three and four constitute the empirical body of the thesis, and discuss the findings of the research. The final chapter summarises key findings of the research and discusses them in relation to the literature.

CHAPTER 2
STUDY AREA AND METHODOLOGY

2.1 Introduction

This chapter comprises two main sections: a description of the study area; and the methodological design of the research. The first part sets out the context to appreciate the water access question in Tamale, by highlighting the demographic and spatial growth dynamics and water infrastructure and access conditions. The second section presents the methodological framework in which the research was conducted, the methods used and how the study acknowledged and addressed ethical issues.

2.2 Water access condition in the study area – Tamale[1]

Over the past century, Tamale has grown massively, from a population of less than 1500 residents in 1907, when it was made the capital of the Northern Territories, to a sprawling metropolis of 371,351 inhabitants in 2010 (Ghana Statistical Service, 2013; Fuseini, 2016). It is the most urbanised settlement in Northern Ghana and the third largest metropolis in Ghana after Accra and Kumasi (Fuseini, 2016). The explosion of Tamale's population has resulted in rapid areal expansion of the urban area. In 1984, the urban area of the city was about 380 ha and 1492 ha in 2005 (Fuseini, Yaro and Yiran, 2017) and has since grown to 2982 ha in 2014 (Fuseini & Kemp, 2016). With an annual growth rate of 4.4% between 2001 and 2014, Tamale's spatial extent is predicted to double by the year 2030 (Fuseini & Kemp, 2016).

This demographic and spatial growth seems to have overstretched the capacity of the city managers to meet the burgeoning requirements for urban infrastructure and services including water. The total piped water distribution network in the city is 797.9km. The metropolis has a single water treatment plant with an installed capacity of approximately 45,000m^3/day since 2008. Official estimates show that about 88 percent of households within Tamale used pipe-borne water in 2010, but only about 40 percent had access to the water within their premises (Ghana Statistical Service, 2013).

Tamale's population growth and outward urban expansion as described above has created hybrid spaces, which exhibit both rural and urban characteristics. These places are referred to

[1] For the purpose of this study, Tamale comprises two local government administrative units – Tamale Metropolitan Assembly and Sagnarigu Municipal Assembly. Ghana Water Company Limited with its offices in Tamale is responsible for urban water supply services in both administrative units. They are considered a unit (denoted as Tamale) in this study to allow use of their aggregate information where relevant.

in this study as peri-urban neighbourhoods. There is no clear geographical delineation of where peri-urban begins or ends, as these spaces are neither uniform in all contexts nor is peri-urban a term that is universally recognised (Peloso, 2014). Kpanvo and Katariga (represented in figure 2.1) were purposively selected for the study because they are connected to Tamale's piped water distribution network, but with low density of the distribution mains, as seen in figure 2.2 and 2.3 respectively. Ghana Water Company Limited (GWCL) therefore supplies piped water to both communities through direct in-house connections, as well as metered community standpipes. The existence of the two water supply approaches provides important ground to explore the factors that influence a household's decision to secure private connections or not and also to understand water access experiences and practices among and between households with connections and those without.

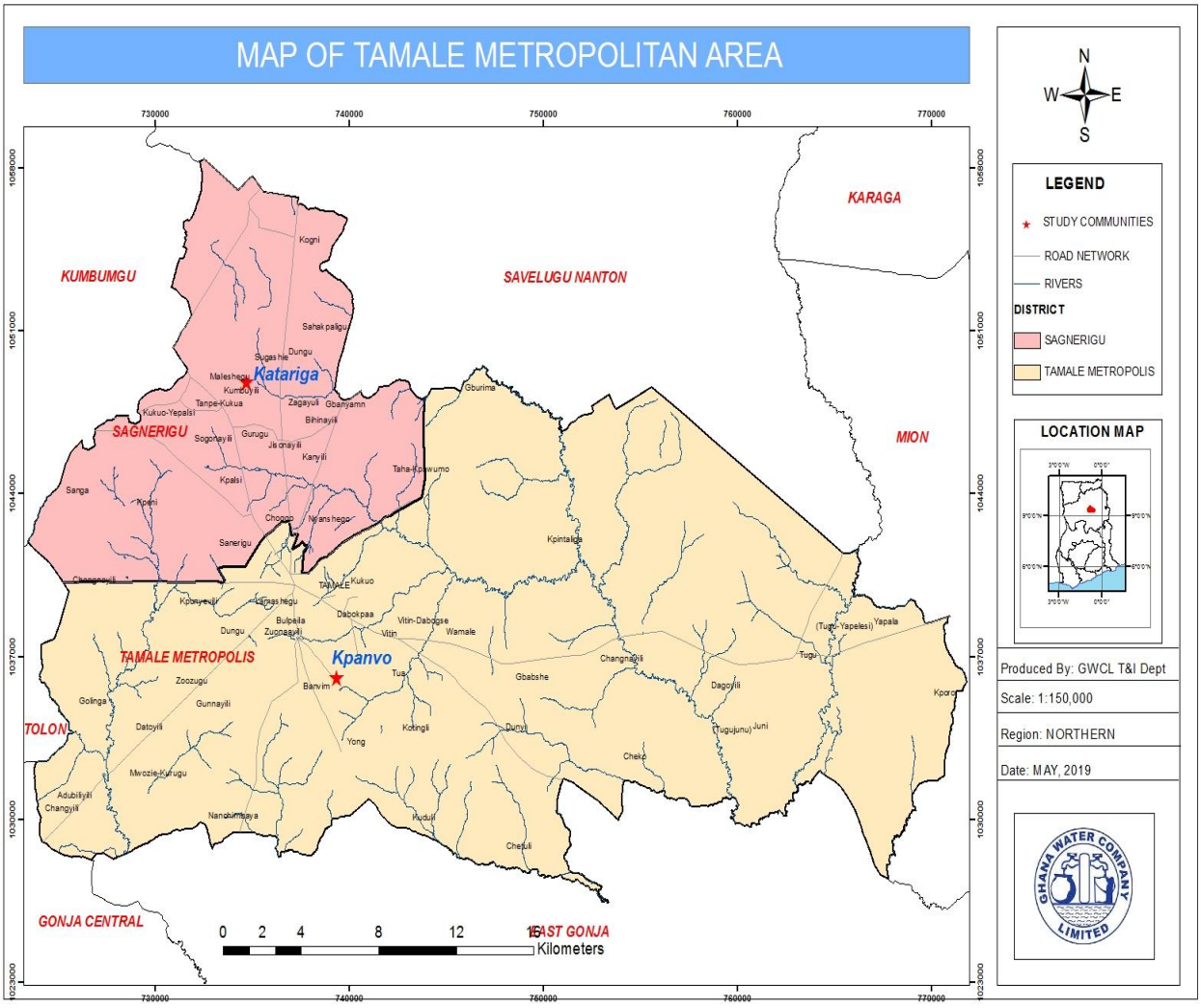

Figure 2.1: Study area (Tamale Metropolitan Area) showing the communities investigated

Source: GWCL Technical and Information Department, Tamale

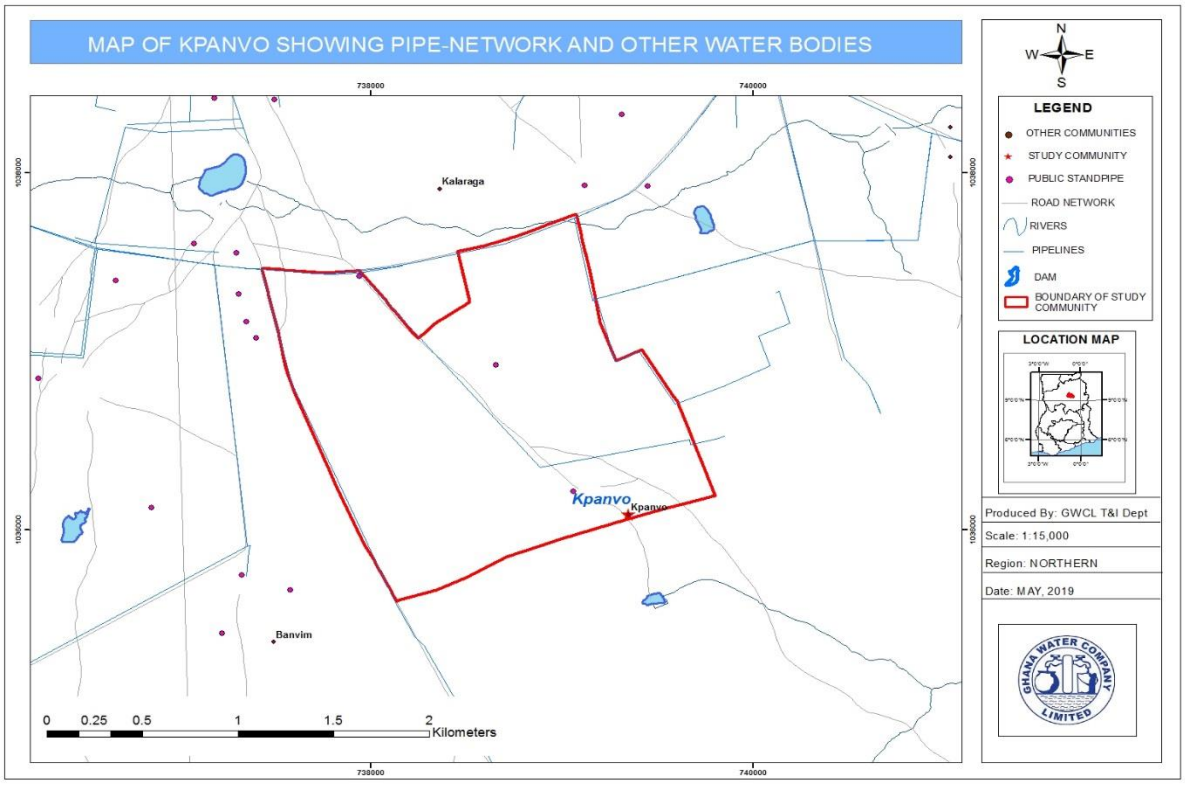

Figure 2.2: Coverage of piped water distribution mains in Kpanvo.

Source: GWCL Technical and Information Department, Tamale

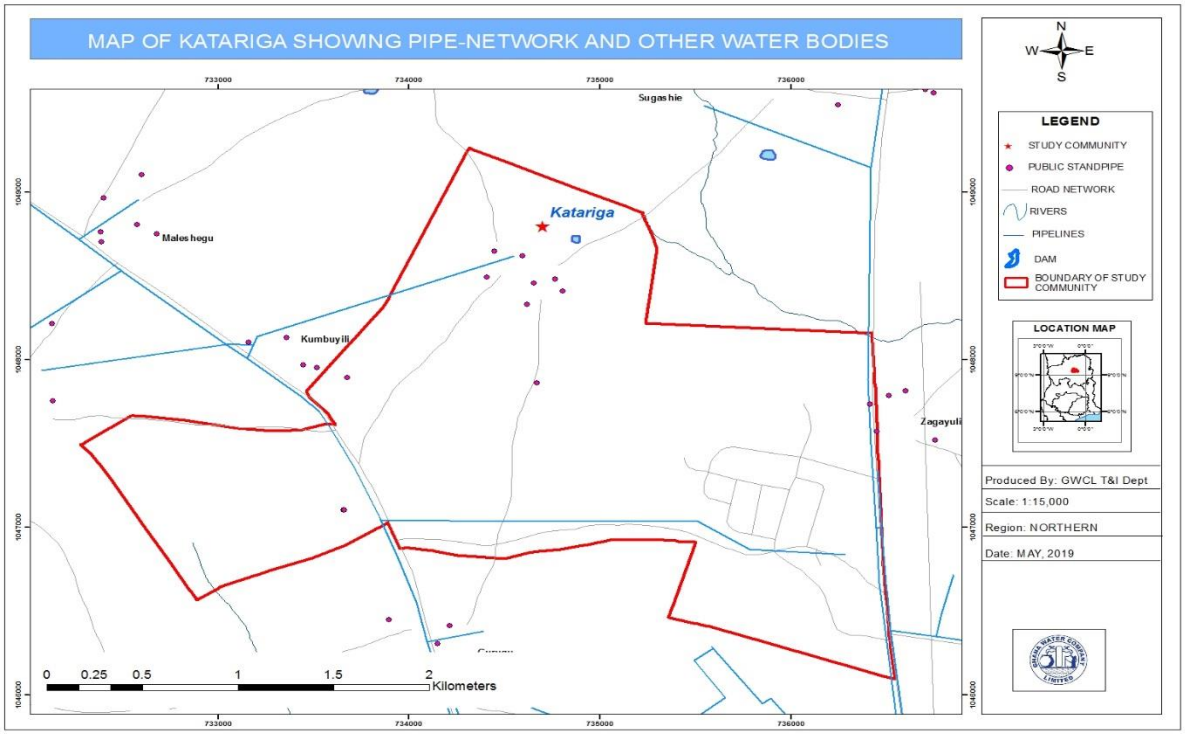

Figure 2.3: Coverage of piped water distribution mains in Katariga.

Source: GWCL Technical and Information Department, Tamale

2.3 Methodology and research design

The study employed a qualitative research approach, executed through the framework of case study design. The detailed, in-depth and intensive investigation associated with this research design (Bryman, 2012; Kothari, 2004; Woodside, 2010) made it suitable to elicit deeper understanding and appreciation of households' water access experiences and practices within the social contexts of the study. As mentioned earlier, the research was conducted in two peri-urban neighbourhoods, making it a multiple case study. The motivation for using two neighbourhoods was not so much about undertaking a comparative study, but to open the scope for understanding more diverse water access experiences and practices and also to explore the situated practices in each neighbourhood. The study draws on interpretivist and constructivist epistemology and ontology respectively. These philosophical orientations consider knowledge as constructed and situated (Bryman, 2012; Golafshani, 2003; Creswell, 2009) which allowed for deeper understanding and appreciation of households' agency in negotiating access to water.

2.4 Data collection methods

The primary data for the study was gathered through participant observations and semi-structured interviews. The fieldwork spanned a period of two and half months (10 weeks). The first six weeks of the fieldwork were used for participant observations of the real time water access practices at public water access points including standpipes and dams within both neighbourhoods. The observations particularly at the public standpipes allowed me to take notes regarding the interactions and negotiations that transpired between the water fetchers and the standpipe agents as well as among the water fetchers themselves. Relevant water access issues that emerged in discussions at the public water sources as well us during informal interactions with residents were also documented. The information gathered at this phase of the fieldwork helped fine-tuned the interview guide containing broad areas explored during in-depth household interviews.

While the participant observations were being conducted, a parallel process of identifying households with direct in-house connections was initiated. Given the predominance of multi-habited compound housing in Tamale (Yakubu et al, 2014) particularly among the indigenous residents of the study localities, a household is used in this study to mean a group of persons that share a common pipe located within their house. Since I spent most of my time almost on a daily basis in the neighbourhoods, visits were made to most of the houses to identify particularly, households with direct in-house connections. The visits to the houses were made

randomly such that large sections of both localities were covered, and the households of interest mapped. During this process in Katariga, two households were found to be involved in tap sharing arrangements with neighbours outside their houses, two suffered disconnections of in-house pipes, and two attempted securing direct in-house connections but were unsuccessful. Also, two households who installed mechanised boreholes, and one who primarily patronised tanker water services were identified in Kpanvo during the house-house visits. All these were important cases and as such they were selected as part of the study. Aside from these, five households each for Kpanvo and Katariga whose in-house pipes were functional were selected from different sections of the neighbourhoods. The remaining households without connections were also randomly selected to be included in the study. Interview dates and time were scheduled at the convenience of the selected households, and I adapted to reschedules from households based on their own changing circumstances. Hence all the selected households were eventually interviewed in their various houses.

The flexibility and in-depth engagement associated with the semi-structured interview (Noor, 2008, Bryman, 2012) allowed me to elicit a wide range of relevant information. This in turn allowed for a broad-based analysis and appreciation of water access experiences and practices in the study localities. While conducting interviews, I also sought permission and observed, photographed and mapped all the households' infrastructure that enable them to gain and maintain access to water.

Discussions at public water sources as well as some household-level interviews were conducted in Dagbanli; one of the local languages in this part of Ghana. Since this is not my mother tongue, the fieldwork for this project was conducted with the assistance of a field assistant whose mother tongue was Dagbanli. The assistant was a university graduate who had gained good experience in collecting field data, and who was known to me during his undergraduate studies when I was a teaching assistant. The field assistant facilitated fourteen (14) household interviews in the local language while I conducted thirteen interviews in the English language. A series of measures were put in place to ensure that the field assistant understood the scope of the research. The research proposal was read together and extensively discussed which enabled the assistant to get a clear focus and the methodological framework for the research before the commencement of field visits for the participant observations and subsequent household in-depth interviews. A pilot household interview was conducted, and audio recorded. Thereafter, a colleague during my undergraduate studies, who extensively speaks and understands the Dagbanli language, reviewed the audio to give feedback on how the questions

were asked in Dagbanli. The feedback on this process was discussed with the field assistant to refine and improve procedures with the main interviewees. In addition, I first conducted most of the interviews in English language in the presence of the field assistant as a further step to let him know the detailed engagement and probing that were required in the interview process. The assistant also paused regularly during interviews in Dagbanli to give an overview of the discussions, which enabled me to make inputs where it was necessary. Daily reflections after the fieldwork were also organised to learn lessons and to address challenges. Major questions during household interviews covered experiences during pipe connections and reasons for non-connection to the taps where applicable, experiences of accessing water from the pipes, how water was obtained during circumstances of interrupted piped services, and factors that facilitate or constrain households' access to water.

Semi-structured interviews were also conducted with two senior officials of GWCL in Tamale office and one public standpipe agent in each community. The interviews with agents sought information about their relationships with GWCL and the standpipe users as well as payment negotiations. Interviews with GWCL also sought to clarify some of the issues raised during household interviews, and to elicit understanding of citywide water access conditions and challenges. In all, thirty (30) interviews were conducted for the research (Table 2.1). Interviews with all the research participants were audiotaped for verbatim transcription.

Locality	Category of research participants				
	Households			Public standpipe agents	GWCL
	In-house connection functional	In-house pipe disconnected	No in-house pipe		
Kpanvo	5	0	9	1	2
Katariga	5	2	5	1	

Table 2.1: Distribution of research participants

2.5 Research validity and reliability

Reliability connotes the stability of research findings and validity concerns the truthfulness of research results (Whittemore, Chase & Mandle, 2001). These two concepts have traditionally been used in connection with quantitative research based on positivist philosophy that seeks to test the generalizability and trustworthiness of research findings (Golafshani, 2003, Bryman, 2012). Their application in qualitative research therefore poses difficulties since qualitative

research strategies seek understanding rather than measurement (Whittemore, Chase & Mandle, 2001; Golafshani, 2003). To reject the notions of reliability and validity in qualitative research could, however, be taken as indicative of a lack of concern with rigour (Bryman, 2012). Yet rigour is needed to differentiate scientific knowledge from fiction (Morse et al, 2002). Qualitative researchers have therefore translated the terms to be more aligned with the interpretivist perspective. The term trustworthiness, which bridges both reliability and validity concepts is substituted for the qualitative paradigm (Morse et al, 2002). The widely used criteria of trustworthiness based on which the rigor of qualitative study is determined include credibility, transferability, dependability and confirmability (Morse et al, 2002, Whittemore, Chase & Mandle, 2001; Golafshani, 2003, Bryman, 2012).

According to Morse et al (2002), self-correcting verifications strategies for ensuring rigor must be mainstreamed into the entire process of qualitative research rather than proclaimed by external reviewers on the completion of the project. In this study, several measures were instituted to enhance the validity and reliability of the collected data. First, there was coherence between the research questions and methods. The participant observations and the semi-structured interviews allowed a more opened view about the contours of the research and thus created room for detailed exploration. A pilot interview was conducted and areas of ambiguities noted, and corrective measures taken prior to the commencement of actual in-depth interviews. All the interviews were conducted in a relaxed atmosphere with open-ended questions, that allowed for asking relevant follow up questions for detailed understanding and also for clarification. This helped to avoid biased answers and offered the space for participants to express themselves very well. In addition, all the interviews were keenly followed, and where relevant, I asked the interviewees some questions they earlier answered, for confirmability of responses.

2.6 Data processing and analysis

All the audiotaped interviews were first transcribed verbatim. The English audios were transcribed personally. Two graduates of University for Development Studies, Ghana with extensive experience in transcription of interviews, crucially in Dagbanli were contracted to transcribe the remaining interviews audios that I could not transcribe personally because of language barrier. These individuals first transcribed one audio interview each, and both transcripts and audios were shared with a lecturer in the University of Ghana whose mother tongue is Dagbanli, to ascertain their accuracy before further transcriptions were made. The interview information was processed using NVivo 12, a qualitative data analysis software. This

software facilitates the organisation of unstructured qualitative information along desired themes and categories through coding. Given that interview data can be richer than predetermined research objectives and questions, an inductive approach was used for the coding such that meaning emerged from the data rather than strict ordering consistent with the research objectives and questions. The coded data was reported in the form of detailed discussions and narratives as seen in chapters three and four.

2.7 Ethical considerations and approval

Researchers in social science are expected to observe certain ethical principles in the conduct of their study so as to avoid conflict of interests and to build mutual trust needed for effective conduct of the study. These principles include informed consent, no harm to research participants, anonymity, confidentiality, and respect for respondent's privacy as well as no deception regarding the real intent of the research (Bryman, 2012, Yin, 2016). These principles were duly followed in the conduct of the study and reporting. Ethical clearance and approval (**attached**) were obtained from the Faculty of Science Research Ethics Committee (FSREC) – University of Cape Town, and every aspect of my responsibilities observed to the best of my abilities. I submitted copies of a letter of introduction (**copy attached**) from the convenor for the MPhil Southern Urbanism programme, to the relevant institutional heads in Tamale, and their approval obtained for the research. Copies of the approved letter were made and shown to leaders of the study communities during entry processes. Prior to the start of all interviews, I gave sufficient information regarding my background and location as well as my research intentions, and followed series of steps, as laid out in ethical clearance application form, to obtain consent for participating in the research. Anonymity concerns have been addressed by not reporting real names of research participants in texts or quotes used in the thesis, and through integration of the responses with those from other participants.

CHAPTER 3:
PIPE INFRASTRUCTURAL EXPERIENCE IN PERI-URBAN TAMALE

3.1 Introduction

One of the key failures of existing ways of thinking about access to water is generalisation of urban space to allow for comparative analysis of water access condition between and among cities. Another key failure is the a priori assumption that when a neighbourhood is connected to water infrastructure usually piped water network implies access to water as discussed in the introduction. In this chapter as well as the next, I will use residents lived experiences of the piped network as well as the everyday strategies and practices of negotiating access to water in Kpanvo and Katariga neighbourhoods of Tamale to show how it is problematic to equate access to water solely to the presence of piped network and to generalise water access conditions in the city.

This chapter shows how residents describe their experience of the piped water infrastructure with particular emphasis on water flows, perceptions of water quality and cost of piped water. Although the pipe network is only one component of the myriad of water infrastructures in the study neighbourhoods, it is given keen attention here because it doubles as the primary medium through which the state provides water in Ghanaian cities and also the most desired among all the interviewed households.

3.2 Narratives of piped water flows: putting Kpanvo and Katariga into perspective

At the inception of my fieldwork, a young man with long modish bear was sitting at the entrance of his barbering shop, when I approached him for a short introductory dialogue. In order to satisfy my curiosity and to get preliminary insights regarding water access in Kpanvo, I asked him, in the process of our interaction, to tell me about the water situation in the neighbourhood. Shaking his head, he said:

> "As for water, we are the last in Tamale, and even the whole of Ghana" (Field note, December 2018).

A few days later, I went back to the community, and this time, I met a retired educationist relaxing in front of his newly opened kiosk where he sells soft drinks and some groceries. He offered me a seat and we initiated a conversation that spanned an hour and culminated with some refreshments. In the process he mentioned:

> I expected water to flow two days ago, and I kept awake for the whole nights, but it did not flow. Sometimes, when you engage Ghana Water Company staff about the situation,

> they will say ‘Tamale is now large, and the machines are now old and inadequate as well’ (Field note, December 2018).

Indeed, the striking remarks that ‘as for water we are the last in Tamale, and even the whole of Ghana’ and the practice of having to keep ‘awake for the whole nights but [pipe] did not flow’ were found to be the lived reality among a majority of the research participants particularly in Kpanvo.

In the main, Kpanvo and Katariga experience striking disparities in piped water flows. While residents of Katariga receive an average of four continuous days of piped water supply per week, water flows for an average of one day per week for those in Kpanvo. As observed and also reported by interviewees, piped water flows in Kpanvo is so erratic and unreliable such that residents sometimes do not receive water for weeks or a month, especially during the dry season.

On one Friday evening, around 6:00pm, I met an energetic young man in front of his rented room in Kpanvo. The landlord recently secured an in-house piped connection. It had only been available for two months at the time of the fieldwork. When I asked the gentleman to tell me his experiences of the pipe service so far, he simply said:

> Nobody will tell you when water will flow. You just have to keep on spying on the pipes, checking, checking if it is flowing. Sometimes it flows nobody even knows. We just connected it for two months ago, so we do not have much experiences on when it opens. But our neighbours who connected before us, said it mostly flows on Sundays and Mondays. So, on those days we have to be consistently checking, and sometimes they may or may not open it. It is not stable (Interview 3).

Interruptions to piped water services were very recurrent in interviews, which serves to exacerbate experiences of water insecurity. A word such as ‘ukpara’ meaning locked, was not uncommon to hear as residents of Kpanvo often deployed it to characterise unyielding pipes and disruptions of water flows.

GWCL does not produce enough water (average daily production of 30,000m^3) each day to meet demand because of weak and inadequate water systems and also unstable electricity that makes production during the day almost impossible. The daily production is further reduced by high rate of unaccounted for or non-revenue water (ranging from 30-40 percent) due to inefficiencies, leakages, and illegal connections. The company reported piped water coverage of 70 percent supplied through a rationing schedule by which certain days are earmarked for

water flows in certain neighbourhoods, with the most served neighbourhoods expected to receive water for maximum of three days in a week (Interview; GWCL, 11th February 2019). As indicated in the above extract, households are very much aware of the likely days they will get water based on their lived experiences of the pipes and also from their neighbours. In reality, however, "they [GWCL] do not seem to fulfil their promises" (Interview 1) as not all the designated days the utility company actually provides water to residents.

Other defining features of piped water flows in Kpanvo are low pressure and short durations of flows. It was found that standpipe users and even some connected households sometimes do not get adequate water supply because the pipes flow not only intermittently but also with low pressure. Water may flow for a mere few hours. The quote below from one standpipe user explicitly emphasises the short durations of water flows:

> We would have not complained if the Bi-water [standpipe] was flowing for us to buy. But it would usually deceive you that it is about to come, and when we send our containers, maybe three or five people will get [to fetch], and it would lock [cease to flow] again (Interview 10).

Residents in Kpanvo also alluded that when they are lucky to receive water supplies, it is usually at night. When I asked one interviewee how the household gets water daily, he shook his head, laughed, and said:

> First of all, we do not get water daily. You understand? We have the pipe in the house, but we do not get water daily. It is not daily. It is once and if we are lucky twice a week, and it is in the night. You have to sacrifice your sleep to get water. If your sleep is deep, then you do not get water (Interview 3).

In addition to the supply of water usually at night, the foregoing interview excerpt buttresses the issues of short durations and erratic piped water supplies as discussed above. For instance, it suggests that if the pipes start to flow at midnight, residents get water for less than six hours.

The above narratives lay bare the unpredictable nature of piped water infrastructure service in Kpanvo, both among households with direct in-house connections and also those who access water from public standpipes. These conditions animated situated everyday water access practices particularly among households with direct connections. Some residents have to sacrifice their sleep on days they expect piped water flows. While this is undoubtedly an adaptive response, it is not sufficient to guarantee access to piped water. As one respondent states: "the last time they came to read the meter, I used only 2 units which means water was

not flowing. I was laying vigil, but water didn't flow" (Interview 1). Others keep 'spying on the pipes' (Interview 3) or leave their showers opened at nights such that the gushing of water from them will give indication of water flows (Interview 6).

Experiences of piped water flows in Katariga tend to contrast in various ways with the foregoing experiences in Kpanvo. As noted earlier, residents of Katariga receive relative continuous flows of piped water. One of the respondents adduced:

> We have in-house pipe connection. … they lock it on Saturday around 7:00pm and open on either Monday morning or evening. At times too, if they do not open it on Monday, it will be opened on Tuesday (Interview 1 K).

All respondents in the neighbourhood tend to concur with the above regarding the number of days they receive water supplies. This was also confirmed during the period of my fieldwork.

Like with regularity, pressure and duration of water flows in Katariga appears to be better relative to the experiences in Kpanvo. Water normally flows with high pressure and all day long (for those with direct connection) as far as it is their turn on the rationing schedule. However, the duration of water flows for inhabitants who access water from the standpipes depends on the operational decisions of the agents assigned to manage the pipes in their respective areas. The agents in Katariga usually open the pipes by 6:00am and lock them again by 7:00pm. Conversely, the agent interviewed in Kpanvo indicated that he opens the pipe anytime he notices water flows especially in the dry season when the flow is more erratic. Thus, the agent has to sometimes compromise his sleep, in order not to miss the chances of standpipe users getting piped water.

Although it may not be possible to generalize about piped water flow patterns in Tamale, residents' narratives tend to suggest that water distribution in the metropolis is characterised by spatial inequalities. The interview excerpt below gives an illustration:

> For Tamale some areas have more problems with water than others. Victory (around Sabon-Gida) is one, that is where I am coming from. My father's house is there. Sometimes one week or two weeks, they will not get water. They will buy from those carrying the 'garawa' [the local name for a cylindrical container used in fetching water], and they too will go to, far places to fetch the water and come and sell. Lamashiegu is also one. There is another area where my mother lives; Uzuju is one. But for this area [Katariga] the water problem is not much.

GWCL is certainly not content with the intra-urban disparities in water flows, pressure and duration. Yet, topographic and network design features are invoked to rationalise the uneven water distribution landscape:

> Some communities benefit because of location advantage. For instance, if we are serving Target, a hilly community, you cannot take the low land communities along the line out. So, the first day you will direct water to target area, the communities at the downstream will get and even Target may get or may not get at all. There are some people that can get about three or four times in a week, but you have not planned it like that. That is how the network has been designed and we cannot do anything about it now (Interview; GWCL,11th February 2019).

The inhabitants of both localities also generally explained water flow conditions in reference to the topographic factors. However, some respondents in Kpanvo also attributed the unreliable piped water supply to weak community leadership to influence and effectively engage the city authorities to address their water access challenge.

> The leadership here [in Kpanvo] is weak. When the chief here was enskinned, he left for Canada and those in charge are not able to control the people. Anything they say the people do not listen. It is the leadership that made this place not to develop. Those in high positions such as the chiefs and strong politicians, when they look at them, they do not normally close their pipes. When they speak, it works.

The above quote also underscores the importance of chiefs [leaders of traditional authority] in community mobilisation and governance, and that residents would most likely submit to the chiefs' directives to engender development. Indeed, chiefs are very revered personalities in Tamale and Ghana at large, and they wield significant influence on development projects in their areas. Perhaps, his presence could have contributed towards addressing the intensity of the water access challenge in the community.

The foregoing account clearly demonstrates a highly differentiated water flows patterns between the study neighbourhoods. Though piped water is being rationed for both neighbourhoods, residents of Kpanvo are more marginalised as they experience highly unreliable water flows aggravated by issues of low pressure compared to the situation in Katariga. This underscores how crucial it is to analyse access to water at the neighbourhood level as it reveals specific challenges that would otherwise be concealed in generalised water access condition in Tamale.

3.3 Residents perceptions of piped water quality, cost of piped water

The quality of water delivered through the pipes is as important as availability or reliability of supplies. All research participants concur that pipe-borne water is of high quality relative to other improved water sources such as boreholes. Nevertheless, some residents recounted instances they received piped water containing debris. When I asked one interviewee of her perception of piped water quality, she laughed and said:

> It is not bad. It is okay. But at times when they lock it [the pipe] and open it again, you will see something like dirt in it [the water], some brown, brown thing, even when you put it in the drum, within small time you will see that [beneath the drum] is full of those things. … the first two or three hours, it will be flowing with dirt, like clay. So, within that period you cannot fetch, unless it takes some time before it becomes normal.

Some other respondents reported similar experiences. Based on this, one respondent perceived that piped water stored in containers is better in terms of quality than when fetched and used immediately. According to her, any debris in the water would have settled when it is stored:

> I think that piped water collected and stored is better than fetching directly from the pipe. At times when you store the water, some clayed particles will settle at the bottom of the container and the water appears very clean. One day, I even fetched directly from the tap to drink, I drunk finished, and realised that there were somethings on my tongue, so when I removed it, it was some reddish ants. So, I think if you store the water for some time, if there is anything in it, you will see it and remove before drinking it.

In this context, the respondent merely equates water quality to a clear appearance of the water. The opening and closing of pipes associated with the water rationing, and also the prevalence of piped bursts and leakages, as reported by both residents and officials of GWCL account for the occasional flows of piped water with dirt, and thus compromise piped water quality in such instances.

Aside from water quality and reliability of supply, the cost of water is a crucial aspect when analysing access to water. After residents have secured in-house connections, they are expected to pay monthly water service bills, calculated based on Public Unity Regulatory Commission's (PURC) approved tariff structure and the quantities of water consumed. Some research participants appear not to know how tariffs are determined, yet they are expected to surrender to the billing technology of water meters:

> How they determine their tariffs, we as lay people cannot understand what goes into that. I wish there will be education for everybody to know how they do the calculation of the bills, so that when you are using it, and the bill comes, you will also be able to calculate to know that this is how much I have consumed. That will in a way help you to help them [GWCL] because you will realise that either you are over using [water] and therefore you moderate it or otherwise. But this is the case, you are there, they bring the bill to you … when they come, and they are reading, they open the thing [meter] and then … That is their work they are doing, they are trained to do that.

Since the final decision has been made through the technology of water meters, water users are obliged to pay in order to maintain access to water. Not all households however have the financial capacity to always pay monthly water service bills, which affect their access to piped water in spite of having direct piped connections. In Katariga, two households with direct connections to the grid suffered disconnections as a result of default payment of monthly water service bills. In this context, water scarcity is neither a function of unavailability of the network that enables water circulation nor the physical absence of water. Rather it is predicated on household's ability to consistently pay water service bills.

The disconnections of pipes are not only applicable to private connections but also metered public standpipes. Both Kpanvo and Katariga has six metered public standpipes, mainly located in the indigenous sections of the neighbourhoods [areas primarily occupied by the first settlers]. Each standpipe is assigned to an agent who sells water in containers to residents without their own connections on pay-as-you fetch principle. However, during fieldwork three standpipes were functional in Katariga and two at Kpanvo. The remaining standpipes were disconnected on accounts of default payments of service bills. Some agents are unable to effectively mobilise the monies for GWCL, leading to the disconnections. The possible causes for the agents' inability to mobilise the monies will be highlighted in a later section where the details of how standpipe agents and users interact, and payment negotiations that happen at the public standpipes are discussed.

3.4 Conclusion

People's lived experiences of water access highlight narratives about piped water flows, perceptions of water quality and the cost of piped water. While the existence of piped water infrastructure in Kpanvo and Katariga is crucial, it does not necessarily guarantee continuous access to water. The realities of water supply interruptions in both neighbourhoods, contrast with the assumption of universal and reliable water services associated with a centralised piped

water network. The high degree of variability in piped water flows patterns and pressure between the two neighbourhoods also serve to question discourses that uncritically generalise conditions of access to water in cities. Residents' narratives also indicate that the assurance of piped water quality may not always be a reality. The occasional flow of piped water containing debris due to the frequent interruptions and the reported piped bursts and leakages are potential threats to piped water quality in the study neighbourhoods and Tamale at large. The above discussions also demonstrate that a household's access to water requires not only a direct connection to the piped network but also the ability to pay water service bills. The monthly service bills appear to surpass the ability of some households with direct connections to pay, which then often lead to disconnections. The various ways households negotiate access to water supply in the context of the frequent interruptions are taken up in the next chapter.

CHAPTER 4:
NEGOTIATING ACCESS TO WATER: HOUSEHOLDS DIVERSE STRATEGIES AND INFRASTRUCTURES

4.1 Introduction

The erratic and unreliable piped water flows discussed above lead residents in both neighbourhoods to negotiate access to water by adopting a multitude of strategies and infrastructures. The strategies each household adopts are mediated by availability of finances and/or the strength of social relations. Some households are able to adopt long-term strategies including the drilling of mechanised boreholes and others who hitherto relied on public standpipes and other sources acquired direct household pipe connections. These strategies have their inherent limitations, but in conjunction with different storage strategy[ies], they are the most effective ways of negotiating unreliable piped water services. Others adopt short-term adaptive responses to water shortages. The ensemble of strategies each household uses is mutable depending on countervailing factors such as changes in financial conditions, and thus makes household access to water from a particular source dynamic and fluid. I describe the most typical of these strategies underscoring factors that shape their use as well as the microspheres of negotiations associated with deployment of some of the strategies.

4.2 Typical households' strategies to improve access to water

A full list of all strategies used by households to gain and maintain access to water are presented in Table 4.1 below. The table illustrates that all the households draw on multiple strategies to secure and maintain access to water. Storing water for future use as well as adoption of water management practices such as reducing the quantities of water used for bathing are common strategies among households with in-house connections and those not connected. I describe below the most typical strategies to access water presented in the table.

Storing water for future use.

Storing water for future use is a widespread and inevitable practice among households in Kpanvo and Katariga. All the households maintain diverse sets of water storage facilities. Water storage thus transverse the sectional difference of connected and not connected households and also the rich/poor divide though the relatively wealthy households are able to procure larger containers. Notable among the storage containers found are underground reservoirs, poly tanks (500-1000 litres capacity), plastic drums, metal drums, earthen ware pots, aluminium pots and jerry can (plastic container with capacity of 20 litres).

Table 4.1: Collection of households' strategies to improve water access

Strategies	Kpanvo														Katariga												
	Households																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13
Private tap connection	x	x	x			x	x								x		x		x	x	*		*				x
Drilling of private borehole				x	x																						
Storing water for future use	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Inter-house taps sharing arrangement																		x							x		
Buying water from public standpipes								x	x	x											x	x	x	x		x	
Buying water from other localities		x						x	x	x																	
Buying water from tanker trucks	x																										
Buying water from tricycle operators									x	x	x	x	x	x													
Buying from private borehole owners			x																								
Buying piped water from neighbourhood resellers						x				x						x											
Buying bottled water			x	x																							
Buying from boreholes at mosque																x										x	
Water gift									x	x						x		x									
Rainwater collections	x	x				x			x	x						x				x	x			x	x	x	
Buying sachet water		x	x	x																							
Collecting water from unimproved sources (wells and dams)								x	x	x											x	x	x		x	x	
Water management practices	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x

* in-house pipe disconnected x – uses the access strategy

Indeed, these water storage facilities are at the heart of the very utility of piped network system in Tamale because

of the prevailing water rationing. As such they are part of water infrastructures in the study sites which contribute to the effectiveness of the networked water system. As the interview quotes below indicate, households who have large storage containers are able to store more water when the pipes flow with adequate pressure and for a long duration. This helps to minimise the risk of water shortages.

> …we have over 37 jerry cans, metallic and plastic drums and [an] underground reservoir to store water. So, before it will finish the pipe will flow again, unless the situation is too critical, in which case we use 'motor king' [motorised tricycle] or motorbike to go and buy at Katariga (Interview 2).

Another respondent adds:

> . … you see this blue container [a drum] behind the poly tank [and the] two barrels; one is good we store water in it. Inside there, is a [earthen ware] pot, we store water there. Apart from that we have 16 'Kufuor gallons' [also known as jerry cans]. So, if water is running all these things, we fill them (Interview 1).

The diverse water storage containers as observed during the field work are dispersed within houses which made it necessary for households with private pipe connections to also use water hoses to facilitate storage practices. The households usually connect the water hoses to the tap and channel water through it to storage containers. Therefore, the network system of water supply cannot in this case be limited to the subterranean pipes through which water circulates but also storage facilities as well as the water hoses that enable water to be channelled to distant storage containers.

Photo: Storage infrastructure: earthen ware pots, plastic drums, metal drums, aluminium pots and jerry cans)

Source: Author

Rainwater collection

During rainy seasons households also use the storage containers to collect and store rainwater to supplement other sources. Tamale experiences a unimodal rainfall regime that span April to October, and a mean annual rainfall of 1100 mm within 95 days of copious rainfall (Fuseini, 2016). Though piped water supply is comparatively reliable during the rainy season, all the interviewed households take advantage of the rains to gain free water and thus negotiate the financial cost dimension of access to pipe-borne water. The quote below is an illustration from one interviewee:

> If you had come here in the rainy season, you would have been amazed of what we do. I can tell you that, when it is rainy season, we use less water from Ghana Water Company. We trap rainwater. So, during the rainy season, the meter readers will come, 'ah but your meter is not reading? I say 'ah, God is giving me water why should my meter read? You will just put containers here, these plastic barrels, we just put one here, one there, and the way we clean them… when the water comes … we have a sieve and when we take it inside and pour on the sieve, it will filter, and we use it. We use it to drink, we use it to wash, we use it to cook, we use it to bath, and we use it for animals.

The respondent goes on to say that he even preferred that he had the rainwater as a permanent source of water for the household use:

> I will even begin to see some of the NGOs to see if they can support me so that I dig underground reservoir. Then I connect PVC into the reservoir so that in rainy season all the water will go in there. I will get a pumping machine and do a connection over that, so that when it is dry season, then I will be getting water from that for usage. When you go, be thinking about that because God gave us a lot of resources that we are wasting.

This shows how individuals are ready to use rainwater harvesting as one of the small-scale decentralised mechanisms of water supply to improve their water access. This suggests the need to consider rainwater harvesting as one of the approaches to water supply in Tamale.

Privately organised and purchased tap connections

Two research participants in Kpanvo who hitherto depended on the public standpipes and other water sources acquired in-house pipe connections during the preceding six months. Despite the unreliable piped water supply, the households alluded that ownership of private tap guarantees some relative water access advantage. When it does flows, it saves them much time and effort in fetching water and also allows them to store adequate water compared to those fetching from public standpipes. However, securing direct pipe connection is an expensive and lengthy process which requires access to certain amount of financial resources and sometimes social relations. The upfront cost for new service connections leaves them exclusively for those with comparatively high financial resources. One woman asked about the average cost of in-house connection, and when told it averages at Seven Hundred Ghana Cedi (GHC700.00); thus 120 US dollars, she exclaimed and said: "just look at how "pehinli" [very poor] I appear, can I afford that?". The woman felt it was impossible for her to raise such an amount to obtain private tap.

Others do not make the effort to inquire about the cost of connection as they automatically assume, they will not be able to afford it. For example, when I asked one respondent about whether she has an idea of the amount of money involved in securing a pipe connection, she replied:

> If you do not have the capability of doing something, do you go to ask of it? If you ask of it and they tell you the amount involved, and they say you should bring the money for them to connect you to the water, and you say, 'I was just asking, it will look odd, or you do not think that?' Because of that we have not asked.

In addition to this respondent not feeling she could afford the connection; the above quote also suggests the respondent did not ask about the amount required because she does not want to appear like she cannot afford a connection. Thus, the respondent thinks that inquiring about the cost and eventually not connecting will tend to expose the household's financial condition.

Other households, however, are forced to cease attempts to connect to water, due to their struggles in raising the money required. Interviews described how two households applied for new service connections, and when given the quotations, they eventually halted the process due to the financial cost. One of them explained:

> The guy who just left here, first when I came, he brought up the idea; and 'you see in life, as we are if you are singing till the point that you no longer get responses; it means that you are forcing yourself beyond acceptable limit'. So, the money is the reason why we have not gone back to water company, but we still have the mind to get it.

This shows how people have made concerted efforts to acquire ownership of private taps, yet the lack of sufficient financial capital has curtailed their efforts. While some residents in Kpanvo cited the erratic piped water flows as their reason for non-connection to the grid as will be seen in the next subsection, lack of financial resources has been the major bottleneck to acquiring direct pipe connections in both localities.

Beyond the significant initial installation costs, securing direct in-house connections sometimes takes lengthy time. Though some interviewees acquired connections within two weeks of tendering their applications, delay was a recurrent theme in most of the households' narratives to the extent that some have to wait for up to three months before they were eventuality connected. Navigating the risk of delay sometimes requires leveraging social relationships and/or paying additional money. One respondent used both by putting 'weight' [money] on the application pursued through informal transactions with the officer in charge of that area in order to expedite the household's pipe connection process:

> "You do not fold your arms and then you feel that … you must put weight [money]. So, when you put weight, they are aware of it, we are aware of it, everybody is aware of it that you have to put weight. …others are ready to something, so if you fold your arms, and say I have registered I have registered, they will not come. It is not even the boss; it is the one in charge of this area".

One respondent also invoked the importance of social relationships with a neighbouring worker of GWCL to circumvent the issue of having the connection process delayed. She states:

> …getting somebody who is working there makes things easier for you because if you go to the office, it is the same procedure, but it takes time. But if you have a known person there, they do it quick. It was not up to a month when we had the pipe. …For Ghana, if they say something is not there, if you know somebody who is also a leader there, you will get it. I lie? [Am I lying?] And when you apply, they will tell you that you will hear from us, they will call you, but it will delay.

While some interviewees alluded that they secured their connections without leveraging any social relationships, the above quotes seem to suggest that those relationships can be very important and may well be utilised by those who have access to them.

Some households who do not have the financial capacity to organise private tap connections negotiate to access water through tap sharing arrangements. This is taken up next.

Tap sharing arrangement

Some households without ownership of private taps enter into tap sharing arrangements with neighbouring houses and then contribute towards the payment of monthly water service bills. Two households in Katariga are involved in this form of arrangement to meet their daily water needs. This mode of negotiating water access requires one to invest in particular forms of social relationships that encompass not only family ties but also neighbourhood relations. While one respondent invoked family ties, the other invested in strong neighbourhood relations to get the buy-in for the arrangement. This intra-house tap sharing arrangement was only identified in Katariga, which can partly be attributed to its comparatively reliable piped water supplies. It was not observed in Kpanvo where piped water services are highly erratic and unreliable. Hence, this is a context-specific arrangement partly influenced by piped water flows conditions.

Not all households, however, succeed in their attempts to use the pipe sharing strategy to access water. One respondent tried to enter into such an arrangement but was unsuccessful. Pointing at a nearby house, she states:

> I went to this house and talked to the owner [the landlord] that I want to join them to be fetching the water so that if the month ends, he will share the bill for us to pay. He said, 'he does not joke [play] with his pipe, so he will not allow me to fetch'. So, I came home. He is just a neighbour; I do not know him.

The respondent is a migrant from Bolga and does not have a family relationship with the landlord, which may have increased the likelihood of gaining access, as exemplified in her

concluding statement: “he is just a neighbour; I do not know him”. Also, the respondent had only been staying in the community for two years, which perhaps limited her ability to develop a strong social relationship with the landlord, which may have increased the likelihood of gaining a buy-in for the tap sharing arrangement. This seem to suggest that actually developing effective social relationships at the neighbourhood level other than family ties may require longer time. This can adversely affect access to water among some new migrants in peri-urban areas, who may not necessarily have family affiliations with other residents in the neighbourhoods. This underscores how social relations significantly influence one’s ability to access water through tap sharing arrangement.

Even if successful at entering into this type of arrangement, it only confers a user-right and not an ownership right, which is needed to control how the tap is used. As such, asymmetrical power relations play a critical role in mediating daily water access. Ownership rights allow the tap owner to enjoy more benefits relative to, as one interviewee describes, the ‘parasitic’ party:

> Well, definitely when you are parasitic, there are some things you cannot enjoy… In everything, the owner has to be considered first. If the pipe starts flowing, they fill their containers first. In the process of filling the containers, if the pipe is locked [goes off] their challenge is already solved.

This suggests that tap owners are more likely to fetch and store more water relative to the other household involved in the arrangement, particularly when that water is being rationed in the city. Surprisingly, however, the approach to sharing water services bills tends to suggest that quantities of water consumed does not influence the amount each party pays:

> When the monthly service bill comes, we share equally and pay. It is about simple mathematics; you just divide the bill into two. When you understand mathematics, you can do everything. At times, the bill will come, and the money is not yet ready. So, we are not comfortable to even set eyes on the owner, because he may think we have the money and do not want to pay.

The adoption of an egalitarian approach to sharing water service bills without considering the quantity of water each party fetches can also aggravate inequality in the arrangement because the tap owner is more likely to use much water than the dependent party, but which cost will be borne by both parties. Also, the ‘parasitic’ party is unable to control expenses on water, making the household members uncomfortable when they are unable to pay the bills promptly.

Contrary to the variable service bills, another household in the arrangement with extended family members pays a fixed amount of Thirty Ghana Cedi (GHS30.00) – 5.53 US Dollars per month for water. The household members fetch water on every Wednesday to fill their storage containers, and only sometimes go back to fetch when they run out of supply:

> The house we have being fetching from, we are family; that is why we even fetch there in the first place. They are my father's son in-laws. When we fetch [water] on Wednesday, unless Wednesday again before we will fetch and when it is up to a month, we pay GHS30.00. At times when our water finish, we go back to fetch small but not to fill all our containers again.

From the above quote, it is difficult to determine whether the fixed monthly payment is shared equally or otherwise, or the amount reflects the quantity of water consumed. Yet it seems to suggest that while tap sharing arrangement based on fixed payment may have its own disadvantages, it offers a relative advantage compared to the variable payment arrangement. For instance, it allows the household to plan expenses on water, which may reduce the risk of non-payment and subsequent discontinuation of the arrangement.

However, the 'parasitic' parties in tap sharing arrangement are fully aware that no matter how it is "when you are doing something' [accessing water from a neighbour's tap], you have to be thinking of the opposite side too". As one respondent in the arrangement alluded:

> Because I am parasitic, I can be taken off at any time. …we are humans and 'provided in our mouth, our tongue and teeth are there, it can slip and bite it [we can err at any time], and the owner can decide to discontinue the arrangement.

The idea that households in this arrangement can be 'taken off at any time' or being perceived as 'parasitic' underscores how their access to water is relational – reliant on others and dependent – and to a certain extent, precarious. Such arrangements require of those parties without outright ownership of the tap to develop and maintain good conduct and constantly invest in strong social relationships with the owners so as to maintain their access to water. The households could have secured direct piped connections as others did as outlined above or even drill private boreholes as discussed below yet lack of access to adequate financial capital has left them with no option than pursuing though useful but also to some extent precarious water access strategy.

Buying water from public standpipes

Poor households who are unable to organise private connections or negotiate tap sharing arrangements primarily buy water from public standpipes in containers frequently on a daily basis. As seen in the table 4.2, the cost of buying water from the public standpipes is certainly higher than water service bills for private taps, but the flexible payment system makes it manageable for some residents. For instance, the two households in Katariga who had their private taps disconnected are able to buy certain amount of water from the public standpipes because of the flexible payment system. Yet daily water purchases can tend to enrol women significantly with the task of paying for water. Some women reported that the daily payments at public standpipes occasionally means their husbands offload the financial burden to them, given that in the study area women are more associated with accessing water:

> Now that it is pay as you fetch, I also use my money to pay for water if he [my husband] does not give me. We are the women, and we use the water to do our work, so we have to struggle to buy the water. The monthly payment [when the standpipes were unmetered] was good, but since we have no option, we cannot complain about the daily payments.

The woman's narrative is a comparison of past payment system and the current pay-as-you fetch principle. In both neighbourhoods, the arrangement for accessing water from the public standpipes started with each household contributing equal amounts on a monthly basis towards payment of a block tariff. The standpipes at the time were not metered. As such, GWCL gave a fixed monthly tariff that households came together to share and pay. This payment system was subsequently found to be problematic because most households defaulted in their monthly payments, and GWCL was unable to recover the money. Consequently, the company installed meters and assigned agents to sell the water to those who can afford on pay-as-you fetch principle. The installation of the meters can thus be seen to be part of what Furlong (2011:460) has termed 'mediating technologies" introduced into infrastructure networks to improve efficiency.

With the monthly payments, the woman was able to access water on a daily basis for her chores, without necessarily thinking about the bill. The new payment system means she cannot get water if she does not have money, yet 'since [she has] no option, [she] cannot complain about the daily payments. Indeed, women in households with direct pipe connections mostly could not give much information about the bills, offering that their husbands were those paying, and they could speak about it appropriately. Hence, a lack of an in-house connection does not only

require women physical efforts to carry water from outside sources, but also increases their financial burden to obtain pipe-borne water.

Navigating the financial burden for daily purchase of water has made standpipe sites arenas of (dis)agreements, negotiations and sometimes contestation between the agents and standpipe users in relation to payment processes. The agents wield and exercise certain amount of power at the standpipe sites in relation to those collecting water, by virtue of their social identity as community standpipes managers. The exercise of this power in relation to payment processes sometimes influence access to water. As one female respondent explains:

> We pay as we fetch. But when you do not have money on a particular day, you can negotiate with the agent to fetch and pay later. If he agrees then you can fetch. If he refuses, then we go to fetch from the dam.

In this context, the agents exercise the power of decision-making as to whether to allow a resident to extend payment to a later date or not. Agents have, however, become very cautious of allowing residents to access water and pay on latter date because of past experiences. One agent related that some people fetched water during occasions and ultimately refused to pay:

> Sometimes if there are occasions, some people will fetch with big tanks and will not pay, and you cannot fight them. The strategy they use is that, they will tell you they need to fetch the water before, and when you exercise patience for them to fetch, then they will eventually run without paying. Just last month [January], two houses had occasions and came to fetch and refused to pay.

To navigate this risk, the agents interviewed expressed that they only allow people they know and trust very well to fetch water on a credit. Thus, social relationships of trust become a defining criterion for a household to fetch water on a credit. In the first place, agents allowing people to fetch water on a credit violates the pay-as-you fetch principle that GWCL instructed them to use. However, fetching water on a credit is a situated everyday practice at the public standpipes. This shows the disjuncture between what the policy allows the agents to do and what they actually do at the standpipes in regards of payment processes. This suggests that rules or policies may not always be implemented as planned but may be adapted or negotiated to reflect context-specific realities.

In addition to making decisions on payment extension, agents determine prices for the various containers used in fetching water at the standpipes. This offers the space for price negotiations as the interview excerpt below from one woman illustrates:

> … when you get there [to the standpipe] the agent tells you how much you will pay for fetching with a particular container. But if you feel like the price is high, you can propose a price and negotiate with him, and if he agrees then you fetch, otherwise you have to go by his price or you find an alternative, which is usually the dam. There are no fixed prices for containers.

In terms of the prices, the agents revealed that though GWCL used jerry cans to determine standardised units to volume to sell the water, the women have developed the strategy of buying other containers that are slightly bigger than standard jerry cans:

> Initially we were selling one jerry can for five pesewas, and continued increasing, and now, a jerry can of water is [sold at] 30 pesewas. Now, the women buy big containers [other than jerry cans] and want to still fetch it at 30 pesewas, which does not tally with the calculations the company did for us.

Also, despite that agents keep records of the number of times each person draws water in preparedness towards the total amount to be paid, some people in their eyes still try to 'cheat' them by contesting the records. Though, I could not validate the claim of cheating it is potentially feasible since some women fetch water over multiple rounds and making it hard to help track of total counts. This occasionally plunges them into confrontations with the stand pipe agents. One of the agents explained:

> …you will use a book and be recording as they are fetching, still some will cheat you, because you will record the number of containers or jerry cans, she has fetched but still she wants to cheat you.

The women's disagreeing with the agents' records, trying to access water with relatively bigger containers than the jerry cans as well as the occasional outright refusal to pay are the strategies in which they subtly or not so subtly contest the agents' power to control water access at the standpipes. These tend to affect the agents' efforts to effectively accumulate the monies, leading to debts. This in turn affects the relationships the agents have with GWCL which has the overall authority on the operation of the standpipes. As the quote below shows GWCL sometimes deny agents their commissions because of debts they incurred:

> In the book, they [GWCL] stated the share of the agents, but in reality, it does not happen. We do not get the money. When they come to take the money and you ask of your share, they will just tell you, 'you have not paid all your debts and you want your share?' Meanwhile, they do not know that the debts are not coming from you [the agent].

Aside from the negotiations about payment processes that happen at the public standpipes, quarrels are not uncommon among water fetchers at the public standpipes:

> At times when we get there [to the standpipe] some people want to fetch three or four containers, and some will come late but want to fetch first leading to fights over water. So, if you fear fight, then at time you cannot fetch water at the community standpipes.

These negotiations and contestations that happen at the standpipes, represent additional layer of complexities of access to water that attention to everyday practices of accessing water particularly at public standpipe sources unfolds and thus complicates water access analysis based solely on the presence of the piped water infrastructure.

Table 4.2: Tariffs for water in Kpanvo and Katariga

Tariffs in Kpanvo and Katariga (November 2018 – February 2019	Unit volume (litres)	Unit price (GHC)	Unit price (US Dollar)	Unit volume comparison (GHC/m^3)	Unit volume comparison (US Dollar /m^3)
GWCL residential					
0-5m^3	1000	2.98	0.68	2.98	0.68
5m^3 +	1000	5.07	1.15	5.07	1.15
Jerrycan (Pipe-borne water)	20	0.30 - 0.50	0.09 – 0.11	15-25	4.50 -5.50
Jerry can (Borehole water)	20	0.25	0.06	12.50	3.00

Source: Author

Drilling private boreholes

The sporadic piped water supply in Kpanvo has forced two research participants to adopt an off-grid strategy to improve access to water. The households drilled mechanised boreholes, leaving them not only independent from GWCL supplies but also relieved of the authority the company exerts on households' access to water. Yet residents need considerable financial capital to install a private mechanised borehole. One household reported expending an amount of Fourteen Thousand Ghana Cedi (GHS14,000.00) -2,580.98 US Dollars on the drilling and installation the of facility. The majority of the residents in the study neighbourhoods,

particularly the indigenes [those who first settled in the neighbourhoods], who are also the most vulnerable to water shortages cannot meet this significant capital requirement. Also, drilling boreholes in the study area involves considerable risk because of unfavourable hydrological conditions. Yet the two households took the risk. One of them noted:

> Some people fear the risk of drilling the borehole without getting water, but we took that risk. …if you fear you cannot eat.

While both households agree that pipe-borne water is of much higher quality relative to water from the boreholes, they are guaranteed relative water security than those dependent on the pipe network. However, mechanised borehole owners can also have their access to water interrupted in circumstances of electricity blackouts. Indeed, like other urban areas in Ghana, electricity is quite unstable in Tamale particularly during the day. As experienced during fieldwork, electricity could go off on average of two times a day and occurs almost every week. The households thus negotiate the risk of water shortages by using the boreholes in conjunction with storage strategy. These allowed them to meet not only their respective household's water needs but also, they are able to sometimes sell water to other residents including those with in-house pipe connections.

The decisions to drill boreholes show that households may not just be interested in the availability of water distribution network in an area, what appears equally important is the reliability of water supply. The a priori rejection of the piped connections also questions which water supply approach is alternative to the other and thus provokes rethinking of water supply services in cities experiencing the coupling factors of inadequate distribution network and erratic water supply.

Buying pipe-borne water from tanker operators

The purchase of water from tanker operators is also one strategy some households use to meet their daily water requirements or in times of water shortages. In Kpanvo, one research participant with ownership of a private tap gave an example of his purchase of water from tanker operators. But given the high cost associated with this strategy as discussed below, the household purchased water from tankers only when the water situation became too unbearable. Another household without private connection depends fundamentally on tanker services. Like the two households who drilled mechanised boreholes discussed above, the head of this household attributed his refusal to acquire private pipe connection to sporadic water supplies being experienced in the neighbourhood. When I asked him of the household's source of water, he exclaimed:

> Our water? We have been buying; have you not seen those poly tanks there? We are buying from tanker operators to fill them. In this neighbourhood, there is an intense water crisis. The pipes are not flowing, it opens occasionally, so short a period that not even the people in the house where the pipe is located can be able to fetch enough; talk less of those who are outside. Unless you just buy. It is because of the bad flow that is why we did not even border ourselves about connecting the pipe.

Contrary to some other interviewees, the head of this household like those who drilled mechanised boreholes, could afford the financial cost of a private connection, but the disincentive stemmed from the risk of connecting without getting water or receiving unreliable supplies. Other respondents in Kpanvo indicated that at some point they used tanker services. At the time of the fieldwork, no research participant patronised tanker services in Katariga, though respondents indicated others do use them.

At the time of fieldwork, GWCL had two tanker water filling points, and the third was under construction with planned operation within the year. Registered tanker operators buy water from these filling points and in turn sell to households that patronize their services. Yet one household in Katariga perceived that tanker water was contaminated, doubting if tanker operators wash inside the tanks and even if they do, there will be remains of particles that will compromise water quality. However, the two interviewees in Kpanvo who presently patronise tanker services perceived the water to be of good quality. One of the states:

> I consider tanker water clean enough because I am not an isolated person. It is serving a lot of people around and nobody has complained they have experience getting unclean water from tanker services.

Apart from the quality debate, the cost of tanker water can be extremely expensive, and thus access to adequate financial resources is crucial in order to use this strategy. Though, GWCL sells the water to the tanker operators based on PURC approved tariffs, it is unable to control at what price they in turn sell the water to the customers. At the time of the fieldwork, the cost of tanker water that used to be eighty Ghana Cedi (GHS80.00) – 14.75 US Dollars had increased to One Hundred and Forty Ghana Cedi (GHS140.00) – 25.81 US Dollar. This water access strategy is thus exclusive to those households with adequate financial capital. Yet, social relationships sometimes help to bid down the cost, but it can even then still remain high. As the quote below indicates the head of the household in Kpanvo, who relies on tanker service as

the major source of water, has establish good social relationships with one of the operators, which enable him to buy the water at a price lower than the prevailing one quoted above:

> The person I have been buying water from is a friend. I used to pay GHS80.00 then later it went up to GHS100 and now, the very last one I bought, GHS120.00 – 22.12 US Dollars When I called him, he mentioned that it was GH140, but he gave to me at GHS120 because he knows me, and any time I call on him to serve me water he will come.

Startlingly however, some tanker water users sometimes do not get what they paid for. The interview excerpt from a respondent who depended mainly on tanker service prior to the installation of private mechanised borehole gives an instructive illustration:

> We bought [tanker] water every two weeks, so in a month we bought two times. We were paying GHC120 every two weeks for water. Even with that if they bring it, they do not give you all the water. They will sell the remaining water to others for additional money. The last time we bought water from them, the small tank was not even full because he sold the water and brought the remaining one to us. My husband realised that the expenses were too much, so we decided that the borehole will help us. Now we have our peace.

The significant cost for tanker water and the tendency for users not getting what they really paid for tends to suggest that tanker operators may be taking advantage of the inadequacies in the city's piped water supply system to exploit customers. Though, tanker operators incur additional expenses on transportation, and buying water from them will certainly attract higher cost, without some control measures tanker operators can exploit customers.

Buying water from privately owned sources (private tap and borehole owners)

Research participants especially in Kpanvo sometimes buy piped water from resellers either within the neighbourhood or beyond or buy water from privately owned mechanised borehole. In fact, some households even with private taps sometimes buy piped water from other communities because of their erratic supplies. One of them noted:

> We go to the nearby communities, for example Katariga to buy piped water. When you go there, they usually ask you 'why to do you have pipe in your house, but you still come to buy water here?' We feel embarrassed any time we are asked such a question.

Respondents who access water through this strategy however recounted the negotiations that need to take place with the owners of water sources. The quote below provides an illustration

of such negotiations at one private tap owner's house in Kpanvo, who stores piped water in underground reservoir and resells to neighbours:

> When you go to fetch sometime like this, the woman will just be interrupting; at times she says you have fetched more than the number of times you actually fetched and will want you to pay for that she thinks. Other times too, when you open the pipe, she will be complaining that you have over opened the pipe. When water spills on the ground, she will speak harshly to you.

Like the tap sharing arrangement, the people who fetch water from the resellers do not have ownership rights to the facility and have to negotiate asymmetrical power relationships during water collection dispensation. Also, since the responsibility for the payment of monthly service bills rests solely on the reseller unlike in the tap sharing arrangement, efforts are made to ensure that maximum returns are made from the sales to enable her to pay the bills, and that lead her to be more attentive to how the tap is opened and also the spillage of water in order to minimise cost. The disagreements on the number of time people actually fetched water was also observed at the standpipes and may well be a general phenomenon in relation to payment processes that residents have to negotiate when accessing water outside of one's home.

Residents buy pipe-borne water from resellers not only within their communities but also beyond. Sometimes buying water outside of the immediate neighbourhood can attract relatively higher prices but water scarcities force some people to do so. In Kpanvo, residents buy pipe-borne from neighbourhood resellers at 30 pesewas per jerry can but as the quote below indicates the price is higher when water is accessed from a vendor in a neighbouring community:

> … the Yong side, there is a place we buy one jerry can for 50 pesewas and you can even go and quarrel with them there because the woman will be speaking shit to you.

Another woman added:

> She [the owner of private tap] can just be there and decide to increase the price of the water anyhow and when we complain to her she would not mind anybody. So, those are the challenges we have over there.

Piped water resellers are able to control prices because their activities are mostly informal and not under the control of Public Utility Regulatory Commission (PURC). Therefore, piped water resellers like the tanker operators discussed above simultaneously enable some people to get water, and also take leverage the pressing need for water during water shortages to potentially exploit those dependent on them. Since piped water actually reach most end-users through

these small-scale service providers, the affordability dimension of access to water cannot be guaranteed at least for some peri-urban residents. Some households may therefore be living proximate to water sources but in reality they still not have access to water, which can only be known by paying attention to every realities of water access.

Erratic piped water supplies in Kpanvo also lead some private tap owners as well as those dependent on community standpipes to occasionally buy water from the borehole owners. As seen in the picture below, some residents sometimes leave their jerry cans to be filled with water and return for them later.

Photo: Borehole owner filling water in jerry cans for buyers

Source: Author

At the time of the fieldwork, two jerry cans of borehole water were sold at Fifty pesewas (GHS0.50) which was found to be cheaper compared to purchasing piped water from vendors. Like private tap owners, the borehole owners always ensure they have adequate water to meet their households demand, and then decide who gets water to buy from them especially when the available quantity is insufficient to meet the needs of all. Interview shows that customer loyalty and other social relations tend to influence borehole owners' decision in this regard:

> I only allow people to fetch if I know I have adequate water for our household use. … those that I am close to and free with; …I cannot deny them water. I will try to sell small to those people to manage if my water is enough. But I cannot leave [them] and sell to the one that I do not know. I try as much as possible to also sell to people who frequently

> buy water here. …because of the water a lot of people want to have good relations with us (Interview 5).

The respondent rarely gets sufficient water beyond her households' needs because of the low yield and sometimes unstable electricity. As such, she can only occasionally sell water. Yet, in the event of water availability, an individual's chances of getting the water is predicated on his or her entrenchment in social relationships with the owner which may also be predicated on the extent of loyalty in respect of frequent water purchases from her.

Buying water from boreholes at mosque

Boreholes are usually not part of the mechanisms of water supply in Ghanaian cities. They are the primarily means through which Community Water and Sanitation Agency (CWSA), Non-Governmental Organisations and philanthropist supply water to small towns and rural communities. However, mechanised and manual boreholes are installed at almost every mosque in Katariga. These boreholes are used by the congregants to perform ablution during prayers. Though the yield is not enough for community-wide use they serve as important sources of water for some households not connected to the pipes. As mentioned earlier, the skewed location of public standpipes primarily at the indigenous areas of the neighbourhoods influence piped water access of those unconnected households in newly built areas. The boreholes at the mosques have become the primary source where some of them buy water on daily basis. Yet, accessing water from the boreholes is extremely time-consuming. One can spend up to two hours on a trip to fetch water especially from the manual boreholes as individuals need to pump and wait several minutes and pump again before a basin can get filled (Field note, February 2019). As seen in the picture below, the woman was pumping when the water stopped, and she had to wait for a while until 15 minutes before pumping again.

Photo: A borehole at a mosque in Katariga

Source: author

Unlike in Katariga, there are no boreholes located at the mosques in Kpanvo. The community leaders reported that some philanthropists came on four occasions to drill boreholes for the community but were compelled to stop when they found that the yield would not be adequate for public use.

Begging and the gift of water

Begging and the gift of water is another conduit through which some households navigate water shortages in both communities. Some research participants reported that at some point they have received or given water for free. Some residents ascribe their decisions for 'gift of water' to religious principles: "my religion tells me that I should be quick to share what I have because sharing is caring and blessed is the hand that gives than the hand that receives". Others practice 'gifts of water' based on feelings of solidarity and of empathy for those relying on dam water.

Yet, social relations and religious ties are very crucial in determining who gets water via this strategy:

> Once [in] a while, … those I relate well with, I make them to come and fetch here, though we pay the bills. My children's 'mallam' [an Islamic religious leader] for instance, sometimes I make him to fetch here. They fetch from the borehole, but it does not flow well.

Also, some residents when left with no option carry containers to neighbours to beg water. Some of these people will simply say, as one respondent, who sometimes gives water alluded: "we just need water to drink".

Others have to foster social relationships order to gain water via water gifts. However, fostered relationships may only help gain a one-time gift of water

> One day, I was inside, and some girls came; they were about five; holding 2 buckets. They knocked at the gate bell; so, I came out. They greeted and said their mother said they should come to me for water. I asked them, 'where is your mother?' And they said Bi-water [one section of Katariga]. Bi-water! 'Does your mother know me?' I do not know them and even their mother. … I gave them the water; they went and came back, and I chased them away … because they did not tell the truth.

Not only households with ownership of private water sources give water. Residents relying on tanker service also give to others. In Katariga, one household is a beneficiary of gifts of water from a neighbour that buys water from tanker operators. According to the respondent, almost all the houses in her area are connected to pipes but the landlords do not let her fetch water. Pointing at a nearby house, she states:

> But this woman gives me some [water]. If I do not get from the borehole; she gives me 2 or 3 basins to manage until the next morning. She does not also have pipe; a tanker brings it for her. She gave the key to my husband when we came here to rent, and that is how we started. She is too kind to us.

One respondent in Kpanvo also indicated he gives water even when he buys from tanker operators. Recipients of gifts of water are certainly not comfortable with the practice, but situations compel them to engage in it. A respondent who was once a beneficiary stated:

> "We use[d] to go to one pastor's house at the back here, it is far, to go and fetch from his reservoir. They will tell us not to pay, but we do not feel … okay. If you continue fetching from somebody's tank and you are not paying … at least you will not feel alright. You may need more water, but you cannot go back".

Overall, people who have the ability to give water help other residents to get certain quantities of water to manage when a household is desperate for water. This gifting accrues respect to the water givers, as one of them alluded: "so being here they respect me". However, gifts of water sometimes put the givers also at risk of water shortages as their own access can be curtailed by

water rationing decisions of GWCL. As such navigating water shortages through gifts of water is not always a reliable strategy.

Illegal water taping from broken pipes or neighbour's tap

Illegal strategies to access water, while not observed personally during field work, were reported by some residents in both communities. One research participant recounted how a neighbour cut into the pipe of a house which was under construction and accessed water there when the pipes are opened. Thus, the neighbour in question access water illegally from the pipes. The approach is done such that the person is able to fetch the water while the meter does not read, as such it is accessed free. One public standpipe attendant also reported how some women sometimes resort to fetching water from broken pipes, and thus reducing their patronage of standpipes during those instances. Similarly, GWCL indicated a massive illegal water access in Tamale:

> [In]a week [,] we can get illegal connections of about three people. Though we have our own physical loses like leaks and bursts but most of the unaccounted or non-revenue water is because of illegal connections. When we arrest them, you will see Alhajis [Islamic religious leaders] coming to beg.

The illegal strategies to accessing water stem primarily from lack of adequate financial resources to connect household pipes or continually purchase sufficient water from public standpipes and other water vendors. The financial constraints also compel some residents to access water from unimproved sources, which is taken up next.

Collecting water from dams and wells

Both Katariga and Kpanvo have dams, which dry up gradually when the rains stop. The dams were constructed not for irrigation purposes but for residents to access water for domestic uses, when the communities were not connected to the water grid. Research revealed that collecting water from these dams is still a widespread practice among some households without direct connections to the pipes. This is more intensive in Kpanvo because of highly irregular piped water supplies. Here, most residents significantly rely on the dam for their daily water needs, at least for washing, bathing and cleaning, and designated piped water for preparation of tea, drinking and at times cooking when the quantity is relatively enough. As respondents alluded dam water is 'unsafe for human consumption' (Interview February 2019) because of the glaring physical impurities and undoubtedly some microbial and faecal contamination. Nevertheless, intense water crisis and lack of financial resources to purchase safe water compel some

residents to occasionally drink dam water. A respondent during the interview, drunk the water when I met her eating, because she had no alternative at the moment. Dam water users mostly add alum for particles to settle or sieve the water before they use it. No respondent in neither community however reported instances of any sickness that is attributable to the consumption of water from the dams.

Photo: The state of Kpanvo Dam in December 2018 (Left) and February 2019 (Right)

Source: Author

Residents of both communities are taking initiatives to prevent the dams from drying up early. The household heads and young men within the indigenous section of Katariga were levied by the community leaders in support of dredging the dam. Inhabitants of Kpanvo are also contributing money to desilt the dam. They started the financial mobilisations towards the project two years ago, a crucial project for households reliant on accessing water from the dam. Aside from the dams, Katariga has one deep well and Kpanvo has two; but one of the wells has not been used since its construction. Inhabitants reported that water in that well is very coloured and unsuitable for use. All the wells have raised walls above the ground surface with the inside walls plastered. They also have covers except one in Kpanvo, whose cover fell inside it. The well being used in Kpanvo was constructed with support from some philanthropists. A device was installed and when the people turn it around, it draws the water for them, but it got damaged and fell inside the well.

Water from the well, as observed in Katariga appears very clean and some people drink it when piped water is not available. The well in Kpanvo was dry and I could not see the appearance of the water, but as seen in the interviewee extract below, the water is not safe for drinking and cooking without treatment.

The well was provided with a cover but later the cover fell inside it, now it is left uncovered throughout the season and animals and all kinds of things fall inside and during rainy season, we start fetching from it again, with all the dirt.

Photo: Images of wells in Kpanvo (right) and Katariga (left)

Source: author

The challenges in accessing water whether from improved or unimproved sources also lead residents in the study neighbourhoods to adopt diverse strategies of reducing water consumption.

Water management practices as ways of improving access to water

Residents in the study neighbourhoods also adjust behaviours in varied ways to navigate the risk of water shortages. Like water storage strategies, management of water is a ubiquitous practice among the inhabitants of both communities. The metering system associated with piped water supply, the unpredictability of supplies, the high financial cost of getting water from other means, as well as the complex negotiations and challenges associated with deployment of some of the water access strategies discussed above, make households to be very conscious of the volume of water they use even if the pipes are flowing. The narrative below from one interviewee with a pipe connection shows the subtle ways water consumption is managed:

> …you see some people […] will fetch water [to] drink. You just know that you cannot finish [drinking] this quantity of water, then you have taken the quantity you can take. Instead of you to keep [the remaining water] to use when you are thirsty again, you see that they pour [it] away. Here [In my household] it doesn't happen. The children have

> been trained to know how to use water. If you want to bath, the fact that you have water doesn't mean that you should waste it. At least you can use half a bucket and bath very well. We are able to use water wisely and the manner in which Ghana Water Company, if they come and see the way we use water… I want to believe that if they come to this area and they want to assess how people use water and awards will be given, I will be one of those who will be awarded.

Most of the households interviewed manage water by reducing the frequency and the quantity of water they use to bath, to the extent that some bath using half a bucket and even once a day.

Some residents also manage water by adopting multipurpose use. Some respondents even with pipe connections occasionally flush their toilets with reserves of water used for bathing. Strikingly, one woman reported she sometimes washes her children's clothes with the same water they have bathed:

> Sometimes I bath children in a basin and after removing them, I put their dirty clothes inside the same water in the basin and wash it, then use clean water to rinse it. We know that if we get used to misusing water when it is available, we will find it difficult during times that water will be scarce.

Others pile up their dirty clothes awaiting days they will get water flows or time to carry the items to the dam for washing.

The foregoing discussion demonstrates that a household's access to water in the study neighbourhoods is constructed through an assemblage of coping strategies, practices and infrastructures. Affluent households are able to organise private water sources including direct household tap connections or drilling of mechanised boreholes, which are supported with storage strategies. Low income households negotiate tap sharing arrangements; enabled by existing social relationships, buy water at public standpipes or from resellers who store water in large containers or those with private mechanised boreholes. Intense water scarcities lead poor households to also engage in practices of begging for water from neighbours, and fetching water from dams and wells. The challenges of accessing water also drove households to manage water consumption by reducing quantities of water used for bathing, and adopting multi-use water practices.

The majority of these access strategies require residents to access water outside of their homes, enabled by certain infrastructures, the focus of the following discussion.

4.3 Infrastructure to access water

It is clear from the foregoing that water infrastructure in the study communities is not limited to the pipes but also include the boreholes, wells and the dams as well as the varied storage facilities. Given that water is not always available in the private homes of households involved in the research, residents use "motor kings" [motorised tricycles], motorbikes, bicycles and tanker trucks to facilitate water collection activities within and beyond the study neighbourhoods. For this purpose, they are considered as water infrastructure. They serve as conduits through which both potable and non-potable water metabolises through the communities to meet the daily water needs of households. In Kpanvo, households who own these infrastructures or have the financial capacity to hire their services rely on them to haul water from the dam (located at the outskirt of the community or at Yong) or fetch piped water from Tuutingli, Kalariga and other neighbouring communities. At the time of the fieldwork motorised tricycle operators charged GHS3.50 for hauling five jerry cans of water, making it a flourishing economic activity in circumstances of network disruptions. As a result of relative stability in piped water supply in Katariga, motorised tricycles, motorbikes and bicycles are rarely used as water infrastructure.

Bicycles are mostly used by young girls and boys to collect water from the dams or pipes within or outside the communities. Bicycle users fetch water into jerry cans and tie them onto the bicycle in order to transport it to the house. Unlike the motorised tricycles, bicycles are solely organised by the various households in support of their water collection endeavour. As such, there is no payment associated with the use of bicycles to fetch water other than the cost of the water itself.

Photo: Facilitating water infrastructure - motorised tricycle, motorbikes and bicycles

Human infrastructures

Apart from the bicycles, motorised tricycles and motorbikes, the residents usually women and young girls, carry water on their heads to their various homes, making them part of the infrastructure that make water to flow. Throughout my fieldwork, it was not rare to see women carry containers with heavy loads of water or wandering in other neighbouring communities in search for water. On one Tuesday morning, around 7:30am, I trekked with two women to the Tuutingli and Yong area in search of piped water. Unfortunately, our efforts proved futile. The pipes in those areas were also not flowing and the women had to eventually resort to fetching water from the dam. The wandering for water is an everyday practice especially among women without their own water sources, and also more intense in Kpanvo. The daily challenge of having to carry water from distant places pose significant risks and consequences on women. One woman in Kpanvo reported to have suffered a miscarriage as a result of the daily embodying of herself to access water:

> I was pregnant and [a doctor] told me not to carry heavy things again but how can day break without you going to the dam to fetch water? If the pipes were flowing, even if it is a small container, that would have helped. But this far place, how can you carry a small container to the dam to fetch water? That will just be a waste of time. So, I continued carrying like that till I suffered a miscarriage in the seventh month, and it was confirmed by the doctor that the heavy loads were the cause. That is what I mean by we are suffering for water.

The phrase ‘suffering for water’ as indicated in the above interview extract was a common leitmotif in local discourses regarding water in both sites, but more pronounced in Kpanvo.

Most residents I encountered and those I interviewed, invoke it to characterise how either lack of pipe connections or inadequate and intermittent piped water supply has routinely left them in difficult moments to get water for daily needs.

Women being at the forefront of water fetching is not necessarily underpinned by their biological status as female, the practice is also mediated essentially by gendered work responsibilities and sociocultural expectations. When one man was asked the question regarding water fetching responsibility, he said:

> You know, down here [Tamale] we know that it is only women; because they are in the house. I just received a call and can go out any moment from now. We just finish up some work this morning, that is why I am here [at home]. I would have been at somewhere struggling to see what we can get to eat.

This statement buttresses the persistence of debates that relegate women's roles in the family to be essentially reproductive as they mainly perform duties including child care, preparation of food, and washing while men engage in more productive roles. Other respondents adduced that women are responsible for water fetching because their household chores are highly dependent on water; from cooking to washing and other chores, and when the man returns home from any place the woman would have to give water to him to drink and to bath. It is precisely because of these gendered work responsibilities that women in households without private connections are enrol with the task of buying water, and also puts them at the forefront of daily negotiations with agents at the public standpipes and with owners of private water sources discussed above.

The narrative below also emphasises the socio-cultural expectations that normalise women engagement in water collecting practices:

> In our traditional set up, women are responsible for water services. … it is weird to see a man carrying water to pour into the house. For a man to do what the wife should be doing while the woman is able to do it, they will just call you a 'woman'. If it is an indoor task, no one sees or complains. It should have been a helping hand to our women, but you can be doing that, and someone will see and say "'kai' God deliver me from what this person is doing". Also, the women are such that when you give them a helping hand from time to time, they go discussing that with their colleagues. So, someone who does not mean you good could just frame off the information to tarnish your image.

Female respondents generally share the view that it is good when men come in to support in fetching water when it becomes critical. However, they do not also want their men to be looked down upon because culturally, men fetching water for household use is considered demeaning. A man who was once impelled by his wife's health condition to engage in fetching water, recounted a comment made by some women that made him felt odd in the activity:

> "we will not allow any man to fetch before us because we also have husbands and have left them at home. So, if that man wants, he should also go and bring the wife to fetch".

This comment also underscores how women themselves normalise water fetching as one of their primary household responsibilities. The water collection activities among women and girls therefore epitomise the agentive capacities of humans forged in the midst of very difficult and sometimes painful circumstances yet represent the building blocks of water access realities in peri-urban contexts of Tamale.

4.4 Conclusion

The diverse strategies and infrastructures households deploy to gain, maintain, and potentially control their access to water highlight the underlying negotiations and power relations that shape household access to water. As all households, with or without direct pipe connections, use a combination of strategies to improve access to water, the assemblage of strategies each household adopts is shaped profoundly by power relations which are socially, economically, and in some instances, physically mediated. Households' entrenchment in social relationships enables tap sharing arrangements among families and neighbours, which makes it possible for some users of public standpipes to negotiate access to water on credit and also to structure the negotiations when accessing water from privately controlled sources. Access to adequate financial resources also makes some households able to obtain direct tap connections, or those dissatisfied with piped infrastructure services to adopt off-grid technologies, particularly the expensive options of installation of private mechanised boreholes or buying water from tanker water operators. Poor households, in comparison, engage in more tenuous access strategies that often require extensive physical effort as they carry water on their heads, bicycles and motorbikes from different sources within and beyond their home and immediate neighbourhood. Though there are pipes some households still collect water largely from unimproved sources in times of piped water shortages, bringing to the fore the issue of the inclusion of so-called unimproved water sources in water infrastructure planning and governance initiatives, particularly where networks are scanty and where continuous supply of piped water cannot be guaranteed.

In a nutshell, access to water in Kpanvo and Katariga exemplify a heterogeneous system of provision that draws on a multitude of strategies and infrastructures. This raises issues regarding urban planning designs that focus solely on piped water infrastructures and standardised systems of provision, planning that often ignores the realities of heterogeneous access strategies.

CHAPTER 5:
THE COMPLEXITIES OF ACCESS TO WATER IN PERI-URBAN TAMALE, GHANA

5.1 Introduction

This case study through in-depth interviewing and participant observations sought to offer insights into how households, both with direct in-house connections and those not connected in Kpanvo and Katariga negotiate access to water. The study fleshed out context-specific water access strategies, practices and experiences, inviting us to take seriously the complexities of access to water. A growing body of water research suggests that access to water is analysed in ways that move beyond the simple presence of water infrastructure to include, crucially: water quality and quantity; reliability of supply; ease of access; cost; and distributional equity (Satterthwaite, 2003; Obeng-Odoom, 2012; Smiley, 2013, Nganyanyuka et al, 2014; Mahama et al, 2014; Amankwa et al, 2014). Drawing on these literatures I argue that the way in which access to water needs to be understood is not simply in terms of access to pipes – as critical as they are – but also in terms of the lived experiences of using and accessing the pipes and the negotiations that structure and are embedded in practices through which access is gained, maintained and potentially controlled. In short, we can only build a resolute understanding of access to water when we pay attention to how access is experienced and negotiated on a daily basis.

This chapter first summarises key findings of the study and discusses them, highlighting their implications for policy, urban water supply and subsequent research.

5.2 Summary of the case study

The previous two chapters described the particular ways in which access to water is negotiated and lived in Kpanvo and Katariga. Practices of piped water rationing in Tamale have created a default situation where continuous access to water even if a household has direct connection is impossible unless compensatory solutions are adopted. What appears very striking however, is the high degree of variability in the experience of water flow interruptions between Kpanvo and Katariga. While piped water flows continuously for an average of four days per week for residents of Katariga, their counterparts in Kpanvo receive water flows on average one day a week. Even in that case, water in Kpanvo flows with low pressure and is intermittent at best. It may flow, for instance, for a mere few hours or run only through the night. In consequence, some households have to deploy subtle adaptive practices of ‘spying on’, in other words, keeping watch of the pipes, leaving showers opened at nights so they can hear when the water is flowing. Some stay vigil at nights on scheduled days to collect water; even with that there is

no guarantee that water will flow. The worst off, residents who depend on public standpipes are unable to access adequate water to meet their households' needs as a result of the intense water rationing, aggravated by the low pressure.

The unreliable piped water supply generally leaves residents to negotiate multiple water access strategies that are economically, socially, and sometimes physically mediated. Residents in both neighbourhoods, resort to buying or installing storage infrastructure such as polytanks, underground reservoirs, and use barrels and pots and jerry cans to collect and store water. Those residents who do not have large containers to store adequate water during periods of pipe flows have to carry containers to their neighbours to beg or trek to other communities to buy water or resort to collecting water from dams. The study clearly demonstrates that negotiating access to water in the study neighbourhoods is greatly shaped by access to financial resources. Some households in Kpanvo rejected direct in-house connections due to the erratic pipe water flows and adopted the expensive options of installation of private mechanised boreholes and were reliant primarily on tanker water services. Apart from these households, a majority of households without direct in-house connections described the connection cost as their primary constraint. While some unconnected households automatically assume, they will not be able to afford access to private connections, others are forced to cease attempts to connect to water, due to their struggles in raising the money required. Yet for some households who are able to secure direct in-house connections, monthly service bills appear to surpass their ability to pay, often leading to disconnections and reversion to the use of public standpipes and fetching water from the dam.

Daily water purchases by households without private tap connections can tend to enrol women significantly with the task of paying for water. Some women reported that the daily payments at public standpipes occasionally means their husbands offload the financial burden to them, given that in the study area women are more associated with collecting and organising water. Navigating the financial burden for daily purchase of water has made standpipe sites arenas of (dis)agreements, negotiations and sometimes contestation between the agents managing them and standpipe users in relation to payment processes. Despite that agents keep records of the number of times each person draws water in preparedness towards the total amount to be paid, some people in their eyes still try to 'cheat' them by contesting the records. Also, some women have developed the strategy of buying other containers that are slightly bigger than standard jerry cans used to determine the sale of water.

The study also shows that household members' social relationships with others provide important means through which access to water is gained, or conversely, may not be gained. Some households in Katariga with inadequate financial capital to acquire private pipe connections are able to enter into tap sharing arrangement with neighbours outside of their homes to access water, which is enabled by the negotiation of social relations of friendship and family ties. Another household who was unable to establish a strong social relationship with neighbours was unsuccessful in the attempt to enter into the tap sharing arrangement, underscoring the importance of these relationships. Some residents also leverage social relationships of trust with public standpipe agents to access water on credit despite that it is not officially allowed.

The research also shows that water infrastructure in Kpanvo and Katariga, includes pipes, but critically also other sources of water (dams, boreholes and wells), storage infrastructure (underground reservoirs, poly tanks, plastic drums, metal drums, earthen ware pots, aluminium pots and jerry cans) and vehicles such as tanker trucks, bicycles, motorbikes and motorised tricycles. Given that water is not always available in the private homes of households involved in the research, residents use the motorised tricycles, motorbikes, bicycles and tanker trucks to facilitate water collection activities within and beyond the study neighbourhoods. Women and girls are also frequently forced to carry containers and trek to other communities to buy pipe-borne water or access water from the dams because of the unreliable piped services, making them also a part of water infrastructure. Men generally are not involved in water collections activities in both neighbourhoods, influenced by gendered work responsibilities and socio-cultural expectations in the neighbourhood context.

5.3 The contingencies of water access: water flowing now and not later

Households narratives of piped water flows emphasise that access to water is contingent for most in the current contexts of Kpanvo and Katariga. The notion of universal and reliable services that undergird the most touted networked water supply model is found to be in sharp contrast with the realities of water flow interruptions experienced in the case study neighbourhoods and Tamale at large. Both those who had in-house connection to the piped water network as well as those who did not, reported erratic water flows. Manu (2015) also found in Adenta Municipality, Accra that about 56 percent of households in the study who had direct pipe connections had never received water flow through their taps since they installed them, and that on average water flows through the pipes approximately once a week. Nganyanyuka et al (2014) reported similar water flow pattern in Dar es Salaam, Tanzania, and

many citizens with piped water connections are forced to wake up at night to fill up reservoirs or to do their washing, as that is the only time when water is flowing. These findings underscore the limitation of equating households' access to water with the existence of or proximity to piped water infrastructure, and suggest the need to pay attention to the conditions of access to water that bear directly on daily experiences. Yakubu et al (2014) for instance reported that about 68 percent of the peri-urban households included in their research in Tamale had in-house piped connections, which suggest a good water access regime. However, paying attention to experiences of water flows reveals that relatively good statistics on household pipe connections may not necessary mean there is improved access to water in those peri-urban localities. It is therefore appropriate that we go beyond the physical presence of the pipes to considering how effectively they actually deliver water to residents.

The study also highlights significant inter-neighbourhood disparities in experiences of water distribution, which suggest that some neighbourhoods in Tamale are more marginalised in terms of water access than others, and which challenges masked in aggregate water coverage statistics of the larger urban context. The findings thus emphasise the importance of analysing access to water at the neighbourhood level rather than at the citywide scale. The differentiated experiences of water flow conditions between the study locations underscore the need for caution in terms of abstracting generalizable understandings with regards to water access situations in peri-urban contexts. Though it may be impossible to see all localities in cities as specific in terms of their water access conditions, it is important that we look at micro geographies of water access. This scale of study allows us not only to see how access to water is complicated but also avoids a tendency to prescribe a one-size-fits-all solutions to water problems in Ghanaian cities. Put differently, it is inappropriate as is often done, to lump all peri-urban localities as one vulnerable group in terms of their susceptibility to limited water access. Situated experiences of water access need to be taken seriously in planning and governance initiatives to ensure responsive, equitable, sustainable and inclusive urban development.

While all research participants perceive piped water to be generally of high quality relative to other improved water sources, such as boreholes and protected deep wells, they also reported instances when water flow contained debris, which might be caused by the rationing practices and reported incidence of frequent pipe bursts and leakages in Tamale. This suggests that the assurance of piped water quality may not always be guaranteed and may be exacerbated by unsafe storage practices found among some households. Cheng et al (2013) for instance

reported that although tested water samples in the Tamale's piped distribution system met quality standards, there was a clear degradation in water quality between the treatment plant and the distribution system, and that 73 percent of household water samples tested positive for total coliforms and 33 percent tested positive for E. coli. Boateng et al (2013) also observed that water from 83 percent of studied samples tested positive for the presence of E coli in household water. At country level, water quality continues to be a predominant concern (Beck et al, 2016) and only 57 percent of Ghana's population have access to water with no detectable E-coli at the point of collection, and 38 percent at the point of use (WHO, 2017). As Songsore (2008) aptly argues "it is not enough to focus on bringing water to the tap" because what is happening "between the tap and the mouth" is also critical in determining health outcomes" (p.9). It is important, therefore, to move beyond the simple designation of water sources as improved by virtue of their design to institute measures that will ensure the designated improved sources actually deliver quality water to residents. Frequent monitoring of water quality and encouragement of household-level treatment practices may help navigate water quality concerns.

5.4 The importance of multiple strategies to access water

Maintaining access to water in the context of frequent interruptions in water flow involves the deployment of multiple strategies. As both households with in-house connections and those without complained about erratic water flows, they simultaneously emphasized the multiple strategies in which they could ameliorate these deficiencies. In many ways, reliability of access to water was constructed by storing water in myriad types of containers which are used during periods when the pipes cease to flow. Storing water is however more effective among those with large storage containers and with private water sources, such as the boreholes and in-house pipe connections. Storage strategies also raise water quality concerns, as the type of containers used and the storage duration significantly influence households water quality (Boateng et al, 2013). Therefore, while storage strategies may help solve quantity dimension of access to water, quality is more likely to be compromised. Other strategies include drilling private mechanised boreholes, buying water from neighbourhood resellers or vendors in other communities, begging and the gift of water from neighbours, and buying water from tanker operators. What appears surprising however is that some households *a priori* rejected pipe connections in favour of private mechanised boreholes which were reported to provide them with comparatively reliable access to water than the intermittent piped water network. This suggests that it is not enough to extend piped water distribution networks to localities and

expect that people will secure connections, equally important is how effective water services are delivered through the pipes to meet residents' water demands. It is therefore important that planning initiatives for urban water supply should prioritise strategies for ensuring effectiveness of piped water service delivery as much as extending coverage of the distribution network. It also points to the need to pay due attention to off-grid technologies of water supply as much as the network and to use the supply approach that would be most effective in specific contexts rather than treating them solely as alternative to the pipe network.

One household also in Kpanvo rejected direct piped connection on account of unreliable supply and instead depends largely on tanker water services while some other connected houses patronise tanker water during periods of intense water shortages. Tanker water services however entail significant cost which makes their use confined to a few who could afford these costs. While registered tanker operators source their water from Ghana Water Company Ltd (GWCL) designated filling points at the rate approved by Public Utility Regulatory Commission (PURC), there are no control mechanisms to ensure that they do not exploit customers by charging exorbitant prices upon delivery. Although tanker operators incur transactional costs, for example, on transportation and maintenance, which rationally will translate into increased water prices to customers, as Ainuson (2010) notes there is no regulatory oversight and no obligation for tanker operators to adhere to the directives of the PURC. This lack of regulation creates the tendency to exploit uninformed customers. Looking at everyday water access experiences and practices thus helps us understand not only the complexity of the actual lived water network and complexity in water access strategies, but also how the precarity of water access is itself open to exploitation. Aside from the financial costs, one interviewee perceives that tanker delivered water is not of suitable quality because she doubts if tanker operators clean inside the tanks and, even if they do, some remains of particles will compromise water quality. While the veracity or otherwise of the perception is not ascertained in the context of this study, Ainuson's (2010) findings in Ashalley-Botwe, Accra confirm this suspicion, showing that the average cleaning time reported by tankers operators ranged from once a month to once every three months, and that drivers climbed into the tanks to clean them using laundry detergents containing bleach. Unreliable piped water services do not only make residents who patronise tanker water vulnerable to exploitation but also, they are likely to access contaminated water. However, the respondents who depend on tanker water or ones who used tanker water in dire situations concur that tanker water appears clean and as such it is of good quality. This resonates with Mahama, Anaman and Osei-Akoto's

(2014) suggestion that for development policies to be responsive to the water access needs of residents in low-income communities, keen attention has to be given to what people agree to be good or bad sources of water. In this regard, water governance initiatives should be directed towards enhancing the factors that facilitate water access or alleviating access constraints in relation to the people's understanding of improved water sources. In the same manner, issues in relation to costs and the tendency for exploitation, as well as the possibility for delivering contaminated water, require putting in place some monitoring and regulatory measures. This is particularly timely as tanker delivered water is now recognised as an improved water source.

5.5 The relational aspects of water access

According to Ribot and Peluso (2003), access analysis should focus on the 'ability' rather than the 'right' to benefit from natural resources such as water. A focus on people's ability brings attention to a multitude of relationships and processes that constrain or enable people to benefit from water. According to these authors certain structural and relational access mechanisms configure how benefits are gained, controlled, and maintained which include but are not limited to capital (generally thought of as access to wealth in the form of finances) and social relations. These relational factors significantly mediate a household's access to water infrastructure and services in the study neighbourhoods. While unconnected households generally desire to secure private tap connections, this desire is unattainable for a majority as they are unable to meet the financial requirements. Yet some connected household are subsequently disconnected due to inability to pay monthly service bills. Conversely some households are able to mobilise money to secure in-house connections, pay monthly water bills, procure water from tanker truck operators, drill mechanised boreholes as well as procure large storage containers to store water for future use despite the significant financial costs these choices entail. The findings thus resonate with previous studies that established that income is a significant determinant of household access to water (see Mahama, Anaman and Osei-Akoto, 2014, Dapaah, 2014, Adams, Boateng and Amoyaw, 2016). This epitomises and perpetuates not only pre-existing inequalities in the neighbourhoods, but also underscores the danger associated with aggregation and generalisations of water access conditions within and between neighbourhoods. Therefore, addressing challenges of connection and transaction costs to access water is as important as extending water networks to peri-urban communities. Thus, efforts focused on the mass extension of distribution networks to peri-urban areas must be accompanied by in-house connection initiatives and water pricing regimes that are more responsive to the challenges of the urban poor. Working closely with community members may lead to better understanding

of their needs and challenges which could in turn allow for proper targeting of water supply interventions.

The study of everyday practices and experiences of water access also brings attention to how social relationships with neighbours, influence access to water. As Sultana (2011) argued, control over water is predominantly dictated by land and technology ownership, while broader social relations mediate access to water. In this case study, while social relationship networks are not of much importance to relatively wealthy households for their daily access to water, they are nonetheless crucial to relatively impoverished ones as these relationships enable those who have them to arrange with neighbours to access water from their taps at a monthly fee. Entering into tap sharing arrangements can therefore be seen as an act of the poor to navigate significant pipe connection costs. Also, some residents beg or receive gifts of water from neighbours in times of shortages. Zug and Graefe (2014) also demonstrate through their theorisation of the 'gift of water' in Khartoum, how relationships among households are important means through which they navigate daily water shortages, by basically receiving gifts of water from their neighbours. Infrastructure crises such as frequent interruption in water flows therefore can trigger generosity and hospitality among urban residents (McFarlane, 2010). The study also found that some residents leverage social relationships of trust with public standpipe agents to access water on credit despite, as discussed above. In such instances, social relationships take primacy over the rules that govern access to water from public standpipes, which suggests that rules or policies may not always be implemented as planned but may be adapted or negotiated to reflect context-specific realities. Since the practice of allowing access to water on credit can be considered an informal act, it affirms works of scholars who noted the entanglement of formal and informal practices in urban water supply and access (see for example Misra, 2014)

Social relationships are also invoked to navigate delays during the process of acquiring direct in-house connections. As detailed above, some households after mobilising money for acquiring connections leverage social relationships with some workers of Ghana Water Company Ltd (GWCL) to expedite connection processes. Velzeboer, Hordijk and Schwartz (2018) also found that in Lilongwe, Malawi, residents need to establish social relations with the utility employees in order to gain access to a formal household connection. Anand (2011) also demonstrated in Mumbai informal settlements how residents' access to the technologies of 'pressure'; the various means that allow water to flow, is mediated as much by capital as by social connections, and thus underscores the usefulness of social relationships in mediating access to water.

5.6 Pieced together water infrastructure: heterogeneous, yet still uncertain

The limitations of the taps in terms of reliability of water supply forced residents to draw on diverse infrastructures to facilitate or improve their access to water. Certainly, water infrastructure can take diverse shapes and function in varied ways across different contexts (Peloso, 2014). In the study neighbourhoods, water infrastructure includes the pipes, other sources of water (dams, boreholes and wells), and storage infrastructure (underground reservoirs, poly tanks, plastic drums, metal drums, earthen ware pots, aluminium pots and jerry cans). Water infrastructure also include tanker trucks, bicycles, motorbikes and motorised tricycles, which I prefer to call facilitating water infrastructure. These infrastructures enable residents to connect and haul water from distant sources within and beyond the study neighbourhoods. In urban areas with adequate piped water distribution network and reliable piped water supply, conceiving tanker trucks, bicycles, motorised tricycles and motorbikes as water infrastructures may appear illogical. Nonetheless, these infrastructures are very crucial even for some households with pipe connections in Kpanvo and are used almost on a daily basis among some unconnected households such that a breakdown of a bicycle aggravates their water access vulnerabilities. Peloso and Morinville (2014) also observed that in extreme cases some inhabitants in peri-urban Ashaiman, Accra, use a car to access water in a neighbouring municipality where supply is found to be comparatively reliable. The heterogeneity of water infrastructures in the study sites thus unsettles the dominant notion of water infrastructure as the network of pipes and the associated assumptions of water service delivery. It emphasises instead the importance of paying attention to context in discussions of water infrastructure and access to water. The riding of bicycles and motorbikes to access water also emphasizes the agentive capacity of humans to adapt to challenges of water access, and that access to water itself is a negotiated reality.

It is also clear from the study that negotiating access to water sometimes means humans themselves become a crucial part of the infrastructure that makes water flow despite the difficulties entailed. Simone (2004) first developed the notion of people as infrastructure to emphasise reciprocal economic collaborations forged among marginalised people in Johannesburg that allow them to construct their livelihoods. Simone's framing of 'people as infrastructure' is thus a recognition that "people are the central means through which materials [water] flow in many cities" Lawhon et al (2014) suggest. When taken in that broad sense, people as infrastructure manifest in the study sites as some households leverage their network of relationships to enter into tap sharing arrangements with neighbours or occasionally receive

gifts of water from neighbours, and other connections discussed above. However, people as infrastructure also manifests in another way beyond social connections or relationships. People use their physical bodies to make water flow from different sources to their homes. Thus, for poorer households, the materiality of the human body also acts as water infrastructure, as a means to access water from public standpipes, boreholes, neighbours taps as well as from the dams located within or beyond the neighbourhood. This form of water infrastructure in the study localities is gendered as only women and girls are those who physically embody themselves to fetch water; a situation mediated by gendered work responsibilities and socio-cultural expectations in the study localities. The gendered responsibility for water collection has made women in households without in-house connections not only part of the infrastructure to make water flow, but also the daily water purchases tend to enrol women significantly with the task of paying for water.

The diverse infrastructures in the study neighbourhoods have their relative capacities, and not all are deployed at the same time. However, given the unreliable piped water supply, all households use diverse combinations of infrastructures to gain and maintain access to water. This tends to align with Lawhon et al 's (2018) concept of the heterogeneous infrastructural configuration, which looks at "infrastructural artefacts not as individual objects but as parts of geographically spread socio-technological configurations […] which might involve many different kinds of technologies, relations, capacities and operations, entailing different risks and power relationships" [p.720]. According to the authors, thinking through heterogeneous infrastructural configuration is to "think about infrastructure from the perspective of residents […] who most often represent the majority urban experience; [and] also to think about residents […] as part of dynamic socio-material configurations" [p.729]. It is precisely this notion of infrastructure that manifest in the study localities, suggesting that our understanding of what constitutes water infrastructure can be enriched by paying attention to the everyday practices through which access to water is gained and maintained. This orients our attention to specificities rather than generic conceptions. This opens up the space to analyse the relationships between the different infrastructures, and the ways in which they complement and sometimes conflict with each other in shaping households water access. In this way, the network can be seen as one of a number of water provision approaches (even if it is ideally the primary one) which should be used in urban environments that are suitable for its deployments while giving formal and adequate attention to other options which may prove rational in certain contexts. As noted in chapter three, residents of both communities are mobilising resources to

dredge and desilt their seasonal dams which supplement piped water in times of scarcity. This initiative does not only reveal the unreliability of piped water supply but also shows that even where pipe network exist, unimproved sources of water may still appear relevant. This suggests that we have to pay attention to the so-called unimproved water sources in planning and governance initiatives to improve water security in peri-urban areas characterised by scanty, erratic and unreliable piped water distribution network.

In sum, this study provides a rich description of the varied and multiple infrastructures, technologies, relations and strategies that make up the urban water network in Tamale. The findings of this study, read together with the work of Simone and Lawhon et al on people as infrastructure, thus challenge notions of infrastructural archipelagos that suggest a disconnect between formally and informally serviced parts of the city, instead finding the notion of infrastructural bricolage and/or meshwork more reflective of the everyday practices and lived realities in many African cities.

5.7 Conclusion: Suffering for water

This research makes legible the ways residents of Kpanvo and Katariga suffer for water despite neighbourhood connection to piped water systems. The disjuncture between the assumption of universal and reliable networked water services and the realities of frequent interruptions or contingencies of piped water distribution are experienced in both neighbourhoods. These realities pose economic, social, and sometimes physical burdens on households, as they inevitably have to mobilise multiple strategies and infrastructures to gain and to maintain access to water. The contingencies of water flows in the study neighbourhoods thus bring into question what sustainable access to water means when water access statistics show household access to drinking water sources piped on premises, but do not give any indication of whether the water is safe to drink or if there is a regular, reliable supply (Satterthwaite, 2016). It also draws attention to the condition of access to water that bears directly on daily experiences and practices.

Though both study neighbourhoods' experience rationed piped water supply, there are significant differences in water flow patterns, raising the need for caution in terms of abstracting generalizable understandings with regards to water access situations in cities and peri-urban contexts in particular. Also, within neighbourhood, households' access to water is circumscribed by the level of access to finances and/or entrenchment in networks of social relationships. Relatively affluent households adopt more effective access strategies such as the

drilling of mechanised boreholes and organising direct households tap connections, while the poor leverage social relationships to access water from neighbours taps or engage in more tenuous and precarious practices and strategies to access water. In sum, it is important to pay attention to the actual lived navigation of the pipe network as well as to recognise the complex, daily experiences and negotiations of water access at the household and neighbourhood level. Research on the micro geographies of water access allow us not only to understand the complexities of water access, but also to avoid a tendency to prescribe a one-size-fit-all solution to water problems in peri-urban contexts and Ghanaian cities in general. Additionally, it challenges us to bring into our analysis of water infrastructure the bicycles, motorbikes, motorkings and human themselves, which are sometimes part of the water infrastructure that make water access possible in cities.

In short, this research suggests that analysis of urban water access go beyond a simple presence of pipes on premises or at close proximity to homes, by bringing the lived experiences of use of and access to water pipes and the negotiations that structure and are embedded in practices through which access is gained, maintained and potentially controlled. Taking these dynamics seriously in planning and governance initiatives could help ensure responsive, equitable, sustainable and inclusive urban water provision and access.

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Appendix

AFRICAN CENTRE FOR CITIES
urbanism from an african perspective

9 November 2018

Dr António Tomás
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African Centre for Cities
Room 2.18, Shell Environmental & Geographical Science Building
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Letter of introduction for Joseph Ngben

To whom it may concern

Please allow me to introduce the bearer of this letter. Joseph Ngben is a national of Ghana, enrolled in the Masters programme in Urban Studies – Southern Urbanism, hosted by the African Centre for Cities in the University of Cape Town, in Cape Town, South Africa, with the student number NGBJO002.

Mr. Ngben is currently working on his dissertation thesis tentatively called *Household strategies to improve water access: water infrastructure and its material and social-political effects, Tamale, Ghana*. For its completion, Mr. Ngben will be doing fieldwork research on water-related topics, for which he will need your collaboration.

In the name of the African Centre for Cities, and as the convener of the Masters programme, I thank you in advance for your participation in Mr. Ngben's research. Please to not hesitate to contact me if you have any query regarding Mr. Ngben's fieldwork project.

Yours sincerely,

Signature Removed

António Tomás

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13 May 2019

Mr Joseph MborijahNgben
Department of Environmental and Geographical Science

RE: Everyday households strategies to improve water access: Water infrastructure and its material and socio-political affects in peri-urban Tamale, Ghana

Dear Mr Joseph Mborijah Ngben

I am pleased to inform you that the Faculty of Science Research Ethics Committee has approved the above-named application for research ethics clearance, subject to the conditions listed below.

- Implement the measures described in your application to ensure that the process of your research is ethically sound; and
- Uphold ethical principles throughout all stages of the research, responding appropriately to unanticipated issues: please contact me if you need advice on ethical issues that arise.

Your approval code is: **FSREC 42 - 2019**

I wish you success in your research.

Yours sincerely

Signature Removed

Dr Shari Daya
Chair: Faculty of Science Research Ethics Committee

Cc: Professor Sophie Oldfield (supervisor)